FINAL

SITE CHARACTERIZATION REPORT

INSTALLATION RESTORATION

PROGRAM

SUFFOLK COUNTY AIRPORT
FIRE TRAINING AREA
WESTHAMPTON BEACH, NEW YORK

JUNE 1989

VOLUME I REPORT

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1.0 EXECUTIVE SUMMARY

This document is the Remedial Investigation (RI) report which has been prepared to describe the investigation of a fire training area (FTA) used at the Suffolk County Airport in Westhampton Beach, Long Island, New York. The airport operated as Westhampton Beach Army Airfield (WBAAF) under the auspices of the U.S. Army during World War II and was deactivated in November 1945. From 1948 to 1951 the WBAAF was leased and used by the Arabian American Oil Company (ARAMCO). The base was reactivated and used by the U.S. Air Force (USAF) from 1951 to 1969, initially in response to the Korean Conflict. The airport was then turned over to Suffolk County and, in 1971, the Air National Guard (ANG) began leasing a portion of the airport. Due to concerns regarding the potential impact of fuels used for fire-training activities on groundwater, the site has been targeted for the ANG Installation Restoration Program (IRP). E.C. Jordan Co. (Jordan) has been given the Remedial Investigation/Feasibility Study (RI/FS) assignment as a subcontractor to Oak Ridge National Laboratories (ORNL), the prime contractor assisting the ANG in implementing the restoration program.

A Phase I Records Search was performed by Dames and Moore for other USAF sites under investigation at the Suffolk County Airport and was amended to include ANG activities associated with those sites. A recent Phase I records search by Hazardous Materials Technical Center (HMTC) for the 77 acres occupied by the ANG has also been completed. A separate Phase I was not performed for this study. Instead, a limited records search was performed for other data in support of the FTA remedial investigation. Other information in the Phase I report is referenced and used directly.

Jordan prepared a Work Plan in response to a Statement of Work issued under the IRP for the Suffolk FTA site. It was reviewed by ORNL, the NY Air National Guard (NYANG), the Air National Guard Support Center (ANGSC), the U.S. Environmental Protection Agency (USEPA), the Suffolk County Department of Health Services (SCDOH), the New York State Department of Environmental Conservation (NYSDEC), the U.S. Department of Justice (USDOJ), and the New York State Department of Law (NYSDOL). Comments received on the Draft Work Plan were incorporated into a Final Work Plan, which was approved before site field investigations began.

The investigation focused mainly on the presence of contaminants in the soils at the FTA burn area, and in groundwater at and downgradient of the FTA site. Surficial and near-surficial soils were sampled to a depth of 4 feet at 43 locations in the FTA. Nine shallow soil borings were advanced to the water table and soil samples were taken. Four piezometers were installed primarily to define groundwater gradients and flow direction in conjunction with water level information from 10 monitoring wells installed for the RI. Soil samples were selected for chemical analysis based on field screening, and two rounds of groundwater quality samples were collected from all new wells and one groundwater sample was also taken from a downgradient piezometer. Water level data were also collected from several existing wells; however, these wells were inadequately designed and secured to provide water quality samples.

Information collected from borings for soil samples and well placement indicated a fairly uniform sand and gravel formation to the depth of the explorations, a maximum of 148 feet. The Gardiner's Clay, which is a regional aquitard for the water table aquifer, was not encountered in the two deep wells. In other respects, the local geology conformed to reported regional patterns.

The water level information and permeability testing conducted in selected wells and piezometers permitted the estimation of hydrogeologic parameters and characteristics of the water table aquifer. The soils are very permeable with an average hydraulic conductivity calculated at 99 ft/day. The hydraulic gradient in the vicinity of the FTA is about 0.0023 ft/ft and, with an assumed porosity of 0.3, the average groundwater velocity is approximately 300 feet/year. The groundwater flow direction immediately downgradient of the FTA is southeasterly, nearly parallel to the hardstand on which the burn area is located. Groundwater does not flow toward the petroleum storage facility located southwest of the FTA, as was once believed.

The principal contaminants in the soils were lead (to 360 parts per million [ppm]), polynuclear aromatics (PNAs) (to 12.2 ppm), xylenes (to 2.8 ppm), and oil and grease (to about 2 percent). Composite samples of surficial and near-surficial soils were analyzed for polychlorinated biphenyls (PCBs), but none were detected. Dibenzofuran was detected at 0.43 ppm in one subsurface sample (JTB-4 at 15 feet).

The principal contaminant detected in the groundwater was 2-butanone. 2-Butanone (MEK) was detected in eight wells: at low concentrations (less than 100 ppb) in six of the wells, and at 56,000 parts per billion (ppb) in MW-107B and 1,400 ppb in MW-101B. Some low concentrations of benzene, xylene, and toluene were detected in MW-103 immediately downgradient of the burn area, but only at a total of 83 ppb.

The present potential pathways of contaminant migration consist of leaching of contaminants in soils by percolating precipitation into groundwater and the transport of solubilized contaminants by the groundwater. The potential for leaching of residual contaminants in soils under current conditions appears to be very low, with little impact to groundwater near the FTA. Releases to air appear to be minimal. Remobilization of residual contaminants in soils could occur with the introduction of more solvents/fuels or the exposure of contaminated soils.

Based on the available data for the site, the following conclusions are as follows:

- o Contamination in the soils at the FTA do not present significant risk to human health and the environment based on a conservative risk scenario.

- o There is no significant fuel contamination in the groundwater within the study area.

- High concentrations of 2-butanone are present in the groundwater both upgradient and downgradient of the FTA; 2-butanone was detected in the FTA soils in only 2 locations and at levels less than the contract detection limit of .01 ppm.

- Not enough information is available to determine the risk of the 2-butanone groundwater contamination, or the magnitude and distribution of the contamination.

- It appears that the source of 2-butanone is not due to ANG activities at the FTA.

The following actions are recommended for the site:

- No further action is necessary to address the FTA soil contamination.

- No significant petroleum contamination is present in site groundwater. Therefore, no further investigation of the impact to the FTA on groundwater is necessary by the ANG.

The following recommendation is for off-site activities:

- Additional investigation of the 2-butanone in groundwater is needed to evaluate the magnitude and distribution, the source, and the risk posed by the groundwater contamination.

2.0 INTRODUCTION

The Suffolk County Airport FTA is located in the Town of Westhampton Beach on Long Island, New York (Figure 2-1). The airport operated as Westhampton Beach Army Airfield (WBAAF) under the auspices of the U.S. Army during World War II and was deactivated in November 1945. From 1948 to 1951 the WBAAF was leased and used by the Arabian American Oil Company (ARAMCO). The base was reactivated and used by the U.S. Air Force (USAF) from 1951 to 1969, initially in response to the Korean Conflict. The airport was then turned over to Suffolk County and, in 1971, the Air National Guard (ANG) began leasing a portion of the airport. The location of the FTA at the airport is shown in Figure 2-2.

Available information indicates that during the years of base/airport operation, fire-training activities were conducted at or near the present FTA location. Flammable liquid waste materials were collected from various base-related activities and used as fuel for the fire-training exercises. These exercises resulted in the introduction of fuels, oils and greases, and (possibly) some solvents to the ground at the FTA. Preliminary investigations in 1982, consisting of the installation and sampling of monitoring wells, indicated the presence of volatile organic compounds (VOCs) at low concentrations in groundwater at the FTA. Distribution of the contamination was not defined and no known formal, complete report of these investigations exists. As a result of these findings, ANGSC has determined that a Remedial Action Plan (RAP) will be developed for the site, subject to results of the remedial investigation. The Department of Defense (DOD) subsequently initiated a Remedial Investigation/Feasibility Study (RI/FS) at the Suffolk County Airport FTA.

2.1 PURPOSE

An RI/FS was undertaken to assess: (1) physiographic site conditions; (2) contaminant conditions resulting from fire-training activities at the site; and (3) any resultant health and/or environmental risks associated with that contamination. The findings of the RI form the technical basis for conducting an FS, which would identify and evaluate remedial technologies potentially applicable to site cleanup. In turn, the FS would be the basis for developing a conceptual design for the selected remedial alternative.

2.2 SCOPE

The scope of work required to fulfill the RI/FS objectives consisted of 12 tasks, which have been described in the Suffolk County Airport FTA Work Plan and are summarized below:

- Task 1 - Plan of Work
- Task 2A - Site Characterization
- Task 2B - Screen Control Measures

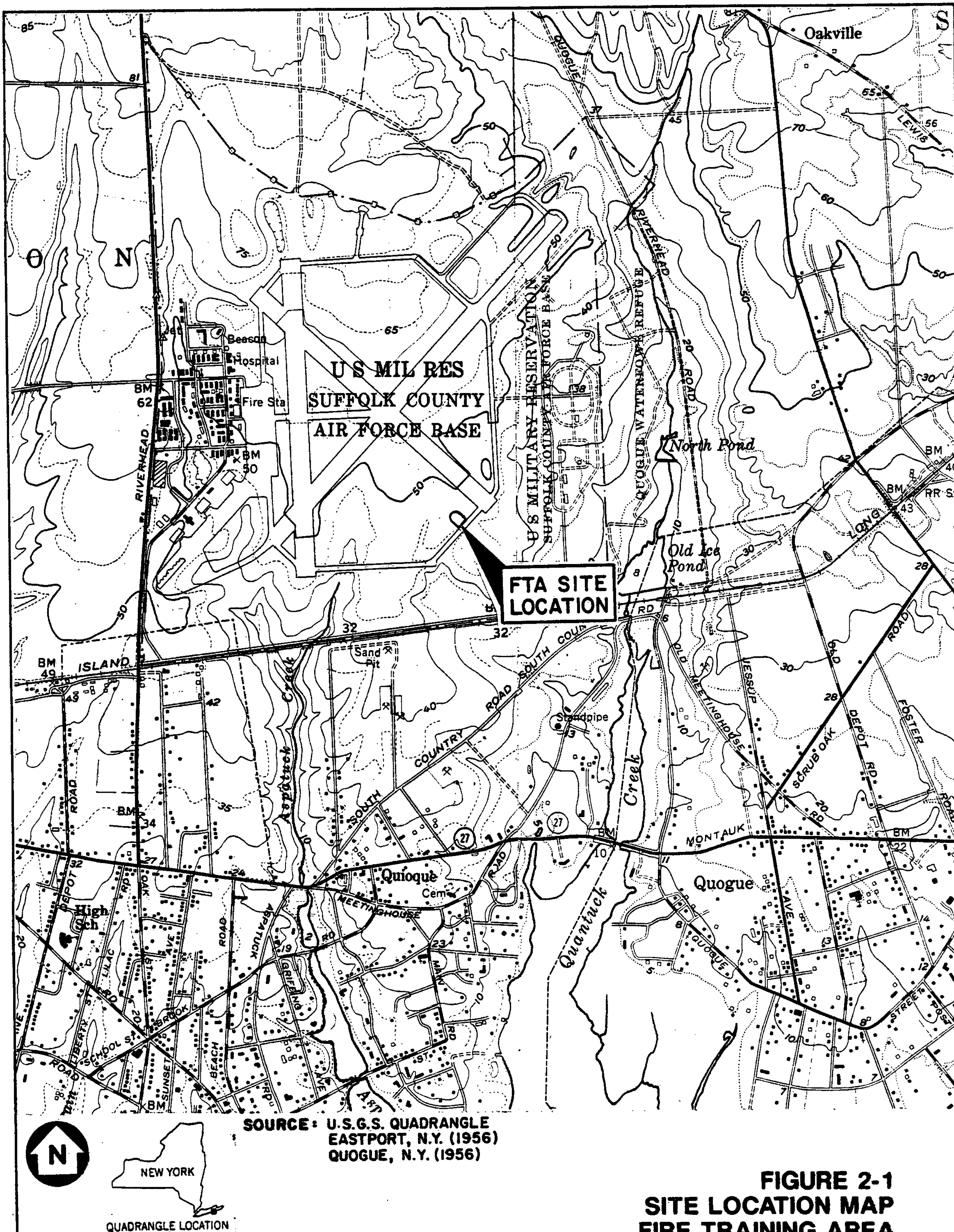

FIGURE 2-1
SITE LOCATION MAP
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

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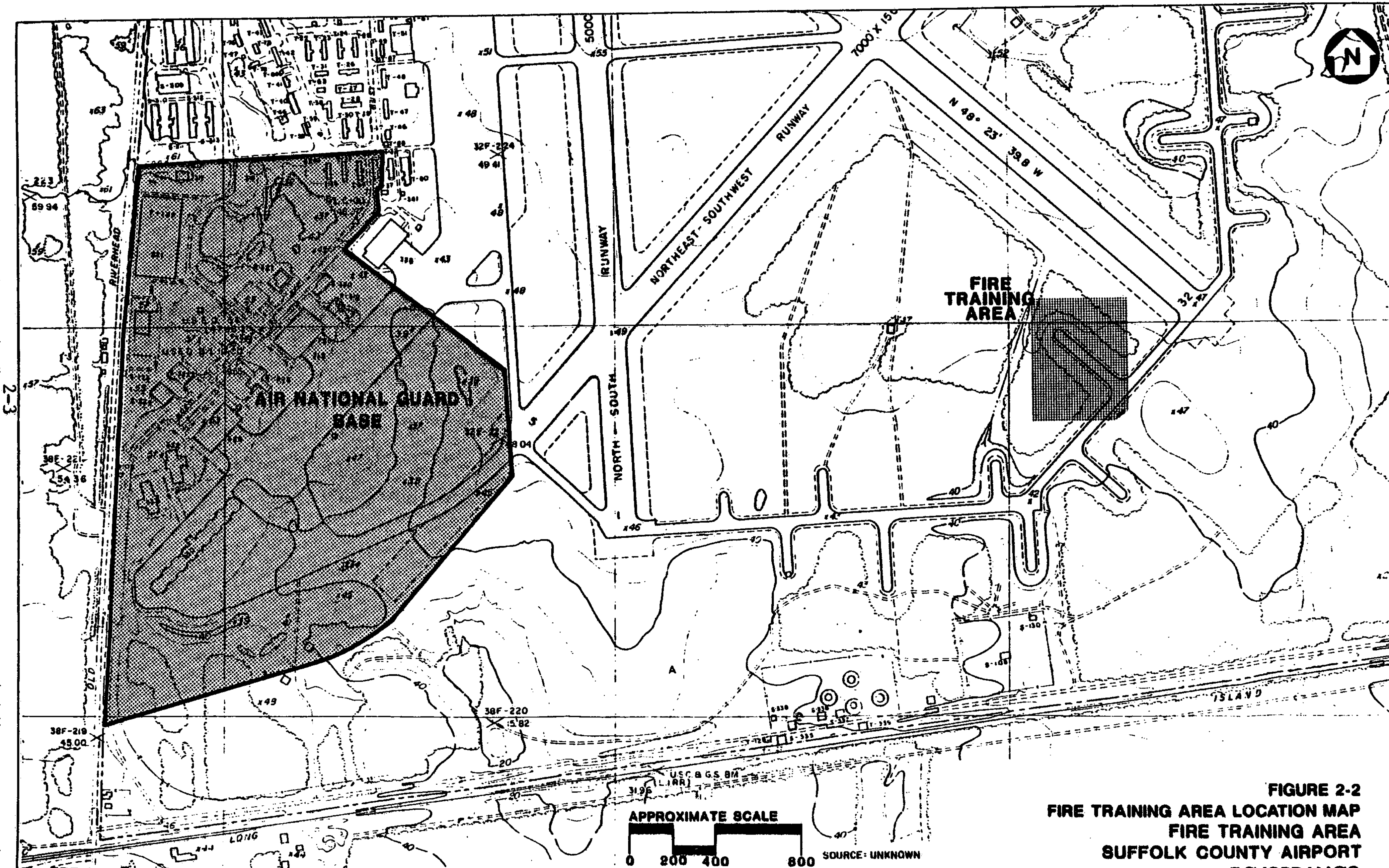


FIGURE 2-2
FIRE TRAINING AREA LOCATION MAP
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT
E.C.JORDAN CO.

- o Task 3 - Develop Detailed Alternatives
- o Task 4 - Evaluate Detailed Alternatives
- o Task 5 - Describe Selected Alternative
- o Task 6 - Prepare Environmental Assessment
- o Task 7 - Prepare Peer Review Draft Remedial Action Plan
- o Task 8 - Prepare Preliminary Draft Remedial Action Plan
- o Task 9 - Prepare Final Draft Remedial Action Plan
- o Task 10 - Meet with Regulatory Agencies and Prepare Final Remedial Action Plan
- o Task 11 - Project Coordination
- o Task 12 - Prepare Designs and Specifications

2.3 PRIOR STUDIES AND INVESTIGATIONS

As part of the overall IRP, Dames and Moore conducted a Phase I Records Search for SCAFB, Suffolk County Airport in 1986. An Addendum to this Phase 1 report was completed to include ANG activities. Also a recent Phase I Records Search by HMTC for the 77 acres occupied by the ANG has been completed. Because much of the Dames and Moore report also pertains to the FTA, only a limited, separate records search has been done for this study.

As part of the RI/FS study, Jordan completed the limited records search, which included a file search of ANG records, interviews with ANG employees, and discussions with the USAF Phase I subcontractor. Results were described in the Suffolk County Airport FTA Work Plan for the RI/FS, prepared by Jordan in November 1986 (see Appendix J).

3.0 PHYSICAL SETTING

The Suffolk County Airport FTA is located in the Town of Westhampton Beach on Long Island, New York. The physical setting of the FTA site is discussed in the following sections. The 1986 Dames and Moore Final Draft Phase I Report, which summarized the majority of information available, was the primary reference for the physical setting of the FTA site. Most of Sections 3.1 through 3.4 is taken directly or summarized from the Phase I report.

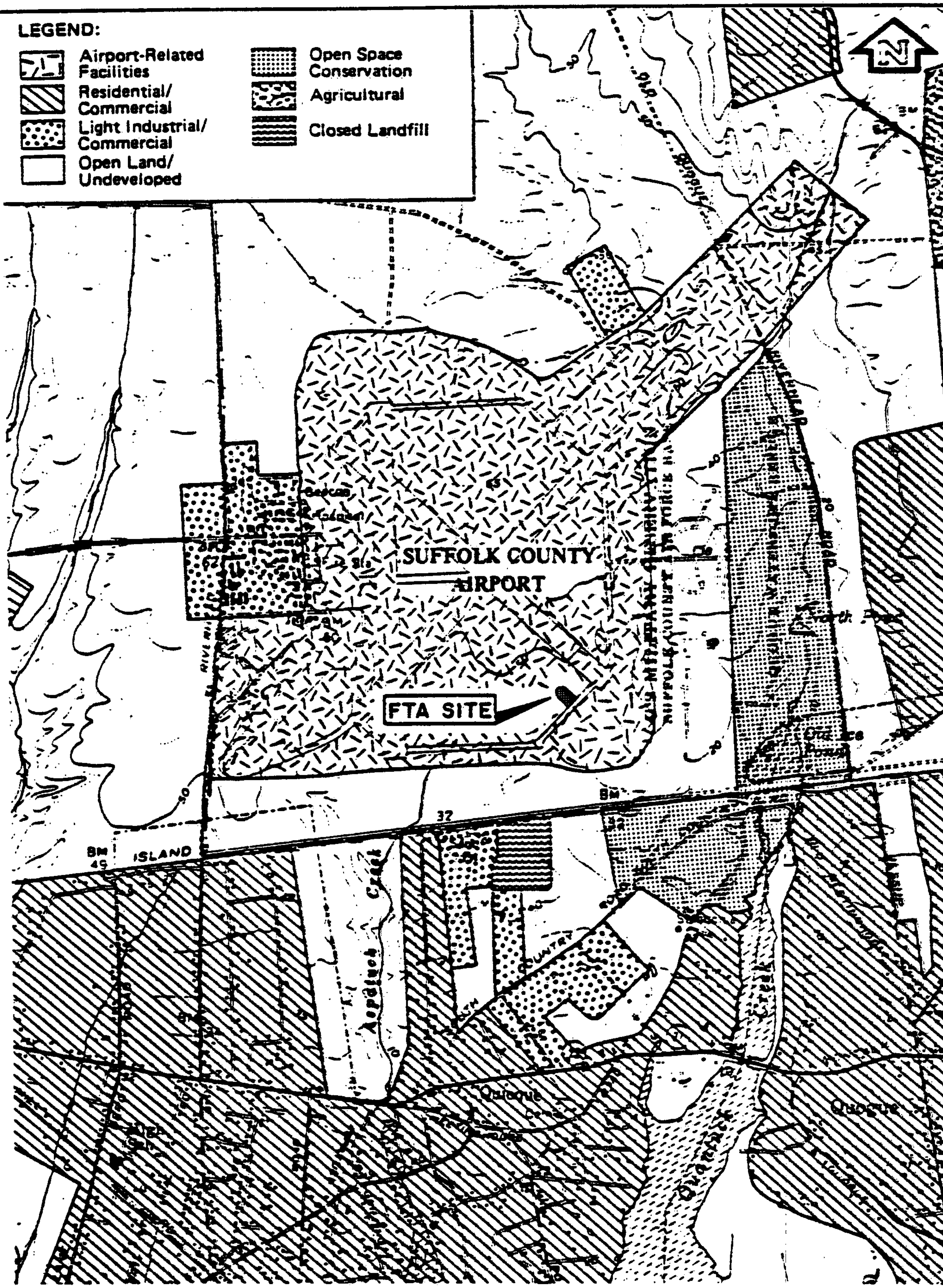
3.1 POPULATION CHARACTERISTICS

The Town of Southampton, New York, surrounds most of the Suffolk County Airport. The incorporated Town of Southampton, which includes the Town of Westhampton Beach, is located in the southwestern corner of the airport and extends south to the Atlantic Ocean. The town has a year-round population of 4,000 and a seasonal population of 20,000. The incorporated Village of Quogue extends south and east from the southeastern corner of the airport (see Figure 2-1). Quogue has a year-round population of 1,200 and seasonal population of 4,000. Residences in the Village of Quogue, located approximately one mile south of the FTA site, would comprise the nearest impacted area. Most of Quogue is residential and zoned for lots ranging from 20,000 to 87,000 square feet.

3.2 LAND USE CHARACTERISTICS

The airport property consists primarily of landing strips, taxiways, and overrun areas (see Figure 2-2). The developed portion is occupied by the Suffolk County Airport, the NYANG, and small commercial establishments. Because the mission of NYANG is aerospace rescue and recovery, most of their use of the area supports those activities, including hangars, maintenance shops, a fire department, and offices. The Suffolk County Airport mainly serves light aircraft and gliders. This area contains a control tower, restaurant, parking area for planes, and aviation-related businesses. Located throughout the former base, but concentrated in the developed portion, are various small businesses occupying buildings originally used by the SCAFB. These tenants include storage companies, automobile service shops, and home improvement and construction companies. The remainder of the airport property consists of undeveloped pine barrens. Figure 3-1 illustrates land use characteristics at the Suffolk County Airport and vicinity.

North of the base, the land is predominantly undeveloped pine barrens; however, it is zoned LI-200 (i.e., light industry in 200,000-square-foot developments with minimum lot sizes of 40,000 square feet). East of the airport property, across Riverhead Road, the land is zoned primarily as CR-200 (i.e., country residences with minimum lot sizes of 200,000 square feet). This area is nearly all undeveloped pine barrens, except for a tract immediately across Riverhead Road from the main entrance to the airport and a housing development further west. The former, zoned LI-40 (i.e., light industry in 40,000-square-foot minimum developments and 20,000-square-foot minimum individual lots), is used



REFERENCE: DAMES AND MOORE PHASE I REPORT (1986)

SCALE IN FEET

0 2000 4000

FIGURE 3-1
LAND USES AT SUFFOLK COUNTY AIRPORT AND VICINITY
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

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for businesses, including a vocational training center. The area further west, zoned R-20 and R-40 (i.e., residential with 20,000- and 40,000-square-foot minimum lot sizes, respectively), contains residential housing, including a subdivision for U.S. Coast Guard personnel.

Immediately southwest in the Town of Westhampton Beach, the land is zoned as light industry and contains some small commercial establishments, a tennis club, and residences. Further south in Westhampton Beach, the area is zoned for a combination of commercial and 15,000-square-foot (minimum) residential lots. The remainder of Westhampton Beach is mostly residential, zoned for 15,000- to 40,000-square-foot lots, with shops and offices along some of the main thoroughfares and in the central business core.

Along the southern side of the base, the land is zoned CR-40 (i.e., country residences with minimum lot sizes of 40,000 square feet), R-20, and R-40; country residential zoning requires a larger minimum house size than residential zoning. More than half of this area is undeveloped woodland, particularly the land surrounding Aspatuck Creek. The remainder includes a residential area, an automobile salvage yard, a closed town landfill, a town maintenance yard, and a sand and gravel quarry.

The eastern third of the southern side of the airport and the southern half of the eastern side are zoned as OSC (i.e., Open Space Conservation). The former area contains two water supply wells and a water tank for the Suffolk County Water Authority, and is considered to be a recharge area for groundwater supplies. The latter area is the Quogue Wildlife Refuge, a 200-acre wildlife management area operated by NYSDEC.

Quantuck Creek and the Village of Quogue lie southeast of these open areas. Most of Quogue is residential and zoned as such for lots of 20,000 to 87,000 square feet. North of the Long Island Railroad tracks in Quogue, the area is zoned for light industry and contains wooded lots and an abandoned village landfill. West of the airport, the land in the Town of Southampton is zoned as CR-80 (i.e., country residences, 80,000-square-foot minimum lots), CR-120 (i.e., country residences, 120,000-square-foot minimum lots), CR-200, and R-20. Although most of this area consists of undeveloped pine barrens, there is a large area presently being farmed, as well as several scattered subdivisions (Dames and Moore, 1986).

3.3 NATURAL RESOURCES

A brief summary of the natural resources is presented in this section. A detailed description of these topics is presented in Appendix A-1. The Suffolk County Airport is located in the Long Island pine barrens. The pine barrens cover much of central Long Island, and are characterized by open, sunlit woodlands dominated by pitch pine (Pinus regida). This overstory species is interspersed with white oak (Quercus alba) and scarlet oak (Q. coccinea). The upper shrub layer is composed almost completely of scrub oak (Q. ilicifolia), while underneath is a low shrub layer of heaths (Ericaceae) generally consisting of black huckleberry (Gaylussacia baccata), early lowbush blueberry (Vaccinium angustifolium), late lowbush blueberry (V. vacillans), bearberry

(Arctostaphylos uva-ursi), and wintergreen (Gaultheria procumbens) (Olsvig, et. al., 1979). Figure 3-2 illustrates the vegetation of Suffolk County Airport and vicinity.

Many other plant species are found within the vicinity of the Suffolk County Airport. Appendix A-2, taken from the 1986 Dames and Moore Report, contains a 1971 vegetation species list for the Quogue Wildlife Refuge, which borders the airport on the eastern side. The FTA site itself is located on a concrete hardstand; no vegetation is present.

As with plant life, many animal species reach maximum abundances or only populate Long Island in the dwarf pine plains. Birds are the most apparent wildlife in the area. Relatively few mammals inhabit the plains because of extreme conditions; among the most common are the white-tailed deer and red fox. Insects are particularly important in the dwarf pine plains since several hundred species have been recorded only in this habitat type. The buck moth (Hemileuca maia) is one of the most visible and abundant insect species in the dwarf pine plains.

It is unlikely that any animal species reside at the FTA site due to the lack of vegetation. However, certain animals may pass through while moving from one wooded area to another during feeding.

3.4 CLIMATOLOGY

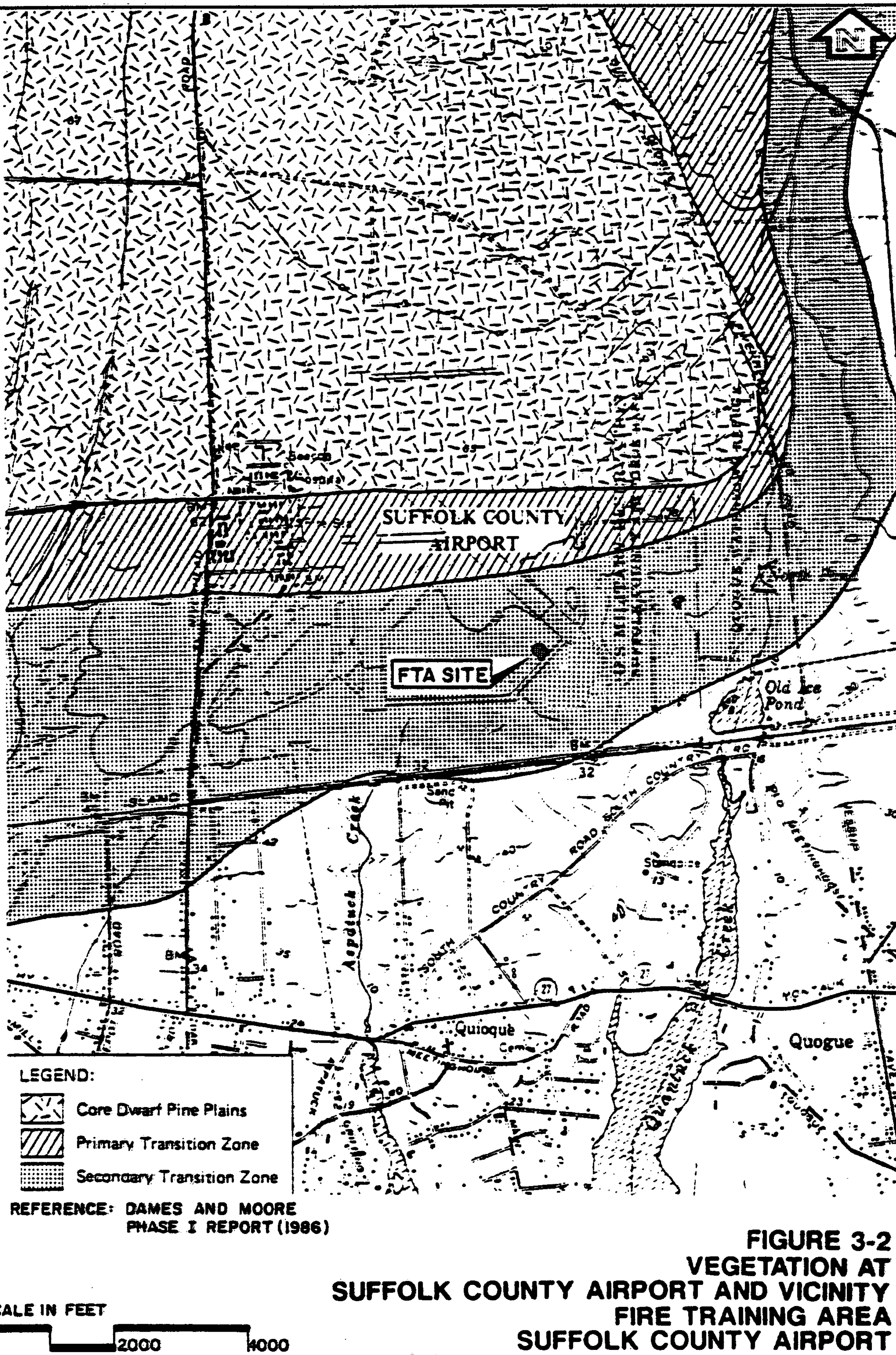
The climate in the area surrounding Suffolk County Airport is humid continental with a maritime influence. Precipitation is 44.5 inches annually, although dry periods are not uncommon. Net precipitation is 14.5 inches per year and rainfall intensity (1 year, 24 hours) is 2.75 inches. Most precipitation percolates into the soil and moves into the subsurface aquifer. Climatological data at Riverhead, Suffolk County, New York, are summarized in Table 3-1.

3.5 SITE DESCRIPTION

The FTA site is composed of five potential source areas associated with past or recent fire-training activities in the vicinity of the current FTA (Figure 3-3). The FTA site itself is located in the southeastern portion of Suffolk County Airport. The current FTA is located on a concrete hardstand off the southern taxiway. The burn pit is a 50- x 50-foot asphalt-lined and curbed containment area. Medium- to fine-grained soils surround the concrete hardstand. Topographically, the terrain is relatively flat with only slight rises to the north and south of the FTA. A more complete site description is presented in Section 5.3.

3.6 PAST SITE OPERATIONS

Reportedly, there were two FTAs on the base: one near the present area, and the other on a dispersed parking hardstand on the western side of the base. The existence of the second FTA has not been confirmed. Aerial photographs



REFERENCE: DAMES AND MOORE
PHASE I REPORT (1986)

FIGURE 3-2
VEGETATION AT
SUFFOLK COUNTY AIRPORT AND VICINITY
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

TEMPERATURE AND PRECIPITATION DATA AT
RIVERHEAD, SUFFOLK COUNTY, NEW YORK

Month	Temperature: Average Daily Maximum	Temperature: Average Daily Minimum	Temperature: 7 years in 10 will have- Maximum temperature equal to or higher than-	Temperature: 7 years in 10 will have- Minimum temperature equal to or lower than-	Precipitation: Average Monthly Total	Precipitation: 3 years in 10 will have- More than-	Precipitation: 3 years in 10 will have- Less than-	Precipitation: Snowfall Average Monthly Total	Precipitation: Snowfall 4 years in 10 will have more than-
	°F	°F	°F	°F	In.	In.	In.	In.	In.
January	38	24	52	11	3.6	3.8	2.9	7	6
February	39	25	51	13	3.3	3.9	2.4	7	7
March	46	31	61	21	4.2	5.0	3.0	6	5
April	58	39	74	30	3.6	4.2	2.9	(1)	(2) 2
May	69	49	81	39	3.5	4.6	2.0	0	___
June	78	58	90	47	2.7	3.5	1.9	0	___
July	83	64	90	55	3.3	4.0	2.1	0	___
August	81	64	87	53	4.3	4.8	2.4	0	___
September	75	57	84	44	3.1	3.7	1.6	0	___
October	65	48	79	35	3.1	4.0	2.3	0	(1 2)
November	54	38	66	26	4.5	5.8	3.1	(1)	(1) 1
December	42	28	57	14	4.2	5.5	2.9	6	7
Year	61	44	92	7	43.4	46.5	40.6	26	28

1 Trace.
2 One year in 10 will have more.

SOURCE: Dames and Moore Phase 1 Report (1986)

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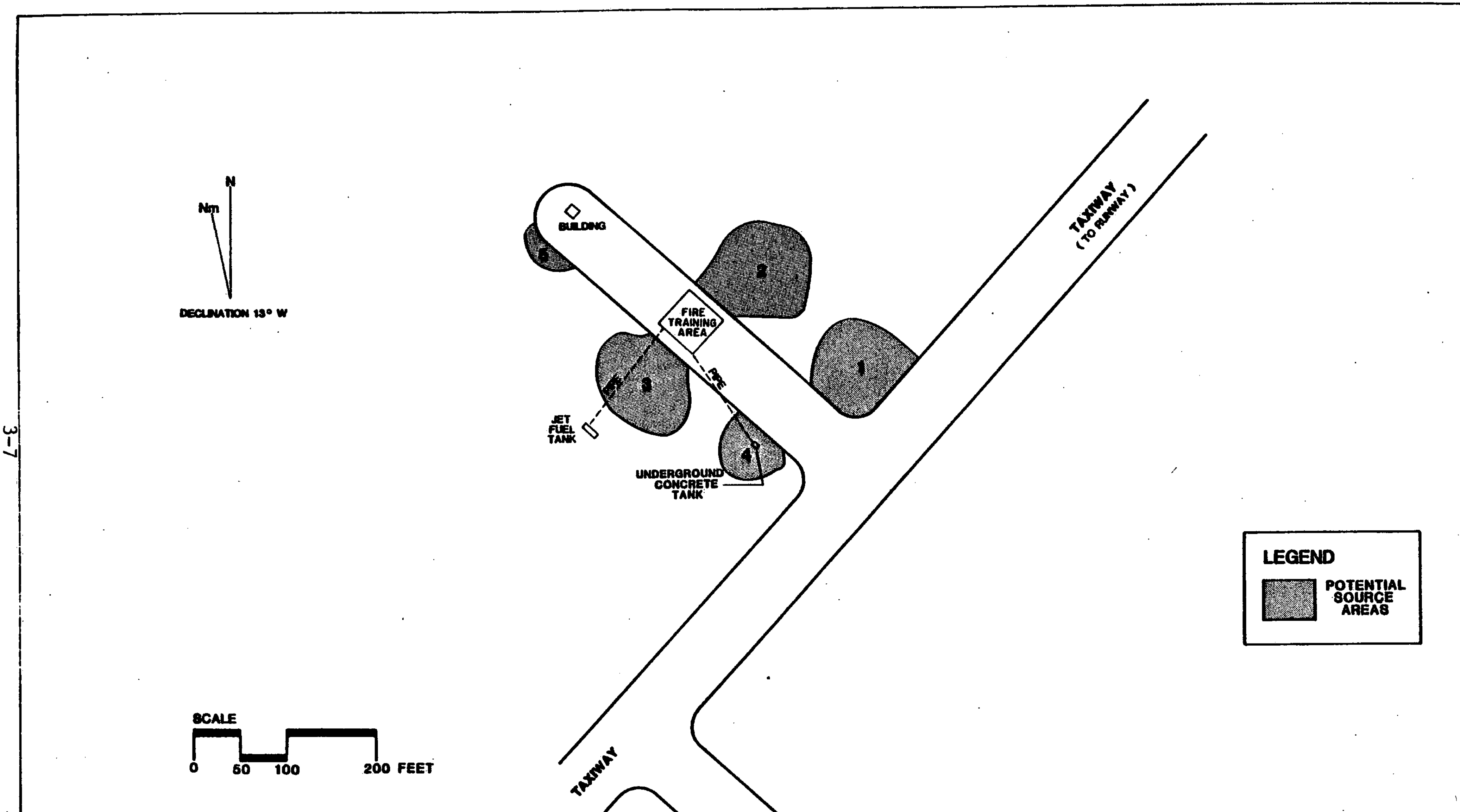

FIGURE 3-3
POTENTIAL SOURCE AREAS
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

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from 1961 show a blackened spot on the ground southeast of the concrete hardstand where the FTA is now located; this is likely the original location of the old FTA.

Aerial photographs from 1969 show a large blackened spot on the concrete hardstand in the location of the current FTA. This burn spot extends off the concrete to the northeastern and southwestern sides. Lack of vegetation in the vicinity also indicates that fire-training activities probably occurred in this area.

During the earlier operation of the base (prior to 1971), waste oils, solvents, and fuels were placed in underground storage tanks located outside hangars and shops. These flammable liquids were collected and transported to the FTA to be burned during bimonthly fire-training exercises. The liquids were poured on the ground (or concrete) and ignited; the fire was then extinguished during the fire-training exercise. Reportedly, the waste liquids used prior to 1971 for fire training included waste oils, solvents (e.g., kerosene, mineral spirits, trichloroethlene, methyl ethyl ketone (2-butanone), toluene), and jet fuel. The quantity of liquids burned at each fire-training exercise is unknown.

Since the ANG moved onto the base in 1971, two major changes have occurred in burn procedures. First, the ANG has used jet fuel (JP-4) as the only flammable liquid since 1971. According to interviews with base personnel, no known waste oils or solvents were used by the ANG in the FTA. Second, in 1978 a concrete curbing was installed around the outside of the fire-training burn area, allowing a new burn procedure to be used. Water was placed inside the curbed area, and 200 to 300 gallons of JP-4 was floated on top and ignited. The fire was extinguished during the exercise, and then reignited to burn off the remaining fuel.

Figure 3-3 shows the five potential source areas at the FTA. Area 1 is a possible location of former fire training. Excess fuel may have run off the FTA hardstand onto areas 2 and 3. Area 4 is the location of an underground concrete tank which was designed (but never used) to receive unburned fuel after a fire training exercise was completed. Area 5 is next to a burned out trailer where trailer fires were simulated. The 1986 Jordan Work Plan for the FTA contains additional information on these areas.

The FTA site is located in a relatively remote portion of the airport property. Although the airport is secured to some degree by the perimeter security fence, there are unmonitored gates in the perimeter fence. The county also leases some airport property to several other commercial ventures, some of which use solvents. ANG personnel familiar with activities at the FTA indicated that they suspect the FTA area may have been used for disposal of waste liquids by unknown persons between fire-training exercise events. The ANG discontinued burning at the FTA in August 1986.

4.0 SITE INVESTIGATION PROGRAM

A field investigation program was prepared by Jordan to define contaminant distributions in soils at the FTA and in groundwater around the FTA. The following sections describe the components of the site investigation program.

4.1 TECHNICAL APPROACH (WORK PLAN OVERVIEW)

In November 1986, Jordan completed the Phase II/IV-A, Part A: Technical Approach, Work Plan, as part of the IRP for the Suffolk County Airport FTA in Westhampton Beach, New York. The Work Plan described the task items necessary for acquiring sufficient data to characterize the FTA and preparing a RAP which presents the selection process of a remedial action alternative for the site. Subtask 2A.1 (Background Review) and Subtask 2A.2 (Well Inventory) of the scope of work were conducted concurrently with Task 1 to develop a site understanding to be used in formulating the site investigation program.

4.2 IDENTIFICATION OF ARARS

Federal and state public health and environmental applicable or relevant and appropriate requirements (ARARs) are environmental requirements that apply to conditions at hazardous waste sites. Applicable requirements are those federal and state requirements that would be legally applicable to the response action if that action were not taken pursuant to Sections 104 and 106 of CERCLA. Requirements that are deemed to be applicable and have jurisdiction in the given situation are considered to be applicable requirements.

Relevant and appropriate requirements are those federal or state requirements that, while not applicable, are designed to apply to problems sufficiently similar so that their application is appropriate. Although the FTA is not a superfund site and is not on the USEPA National Priority List (NPL), ARARs have been identified to help guide the investigation and evaluation of the site.

ARARs are also defined as:

- any standard requirement, criteria, or limitation under any federal environmental law; and
- any promulgated standard, requirement, criteria, or limitation under a state environmental or facility siting law that is more stringent than any federal standard, requirement, criteria, or limitation.

Under this description of ARARs many state and federal environmental requirements must be considered. These requirements include ARARs that govern the extent of site cleanup; ARARs that pertain to existing site features; ARARs that pertain to proposed site remedies; and ARARs that govern implementation of the selected site remedy.

Some preliminary ARARs have been identified and are listed in Appendix L.

4.3 SURVEY AND BASE MAP PREPARATION

As part of Subtask 2A.4 (Monitoring Well Program), a ground survey was conducted and a base map prepared for the FTA site. Jordan conducted a field survey at the site in May 1987. Well elevations, ground surface elevations, and well locations were determined to the nearest 0.01, 0.1, and 1.0 foot, respectively. A base map for the site, which also includes regional groundwater contour lines and flow directions, is presented as Plate 1 contained in a pocket at the end of this report.

5.0 SOILS

The interpretation of geologic conditions at the site is based on subsurface explorations and existing geologic reports for the area in the FTA vicinity. The exploration program, surficial soils, geology, sampling, and analytical results are presented in this section. The 1986 Dames and Moore Draft Phase I Report, which summarized a number of the available geologic reports, was the primary soil and geologic reference.

5.1 HAND AUGERS AND BORINGS

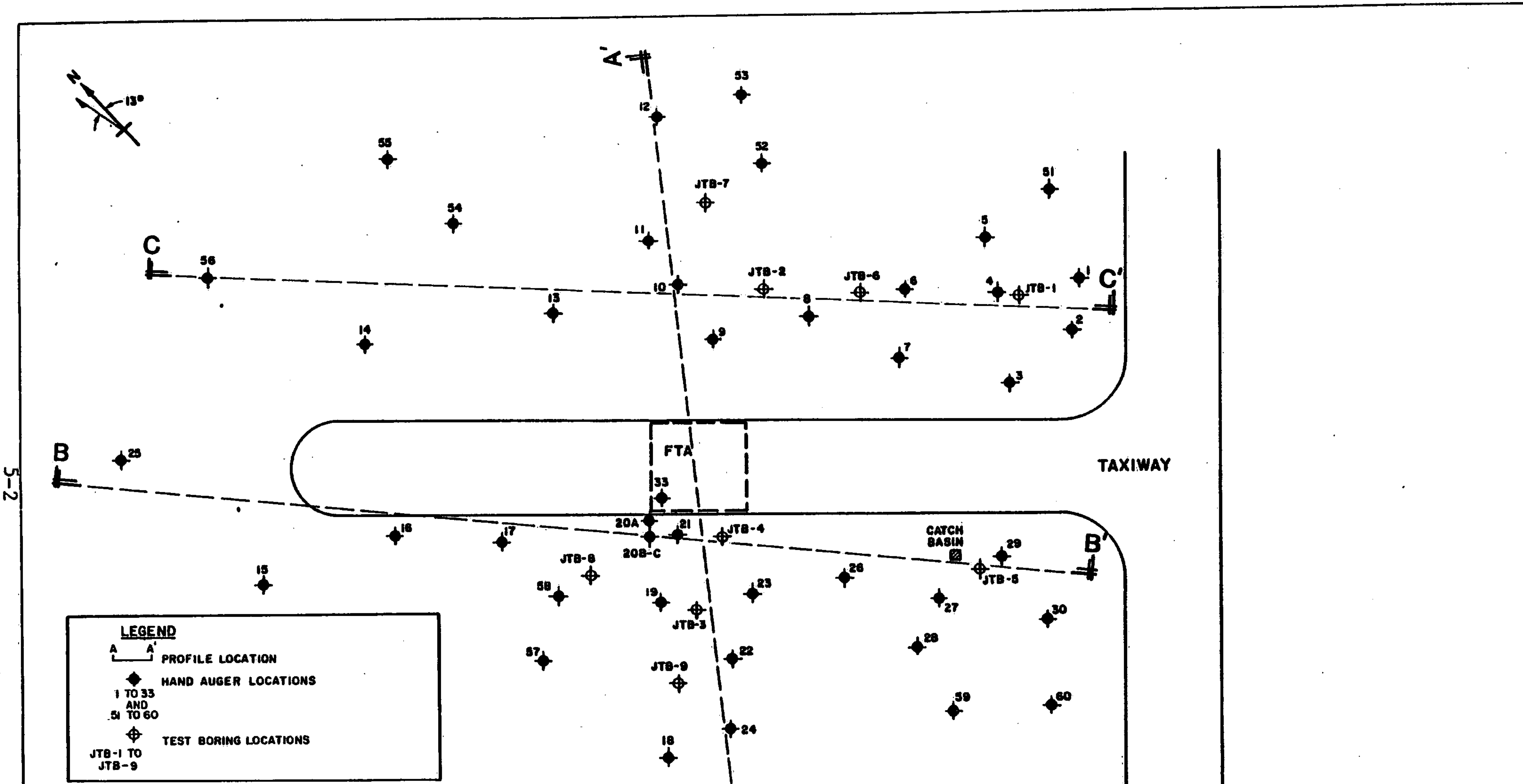
Soil samples were collected with hand augers and from soil borings at the FTA site to characterize the shallow and subsurface soils. The following sections describe these investigations.

5.1.1 Hand Augers

Figure 5-1 shows hand-auger and test-boring locations at the FTA site. Shallow soils were sampled with a hand-bucket auger at 43 locations. Samples were collected at depths of 0 to 0.5 feet, 1.5 to 2.0 feet, and 3.5 to 4.0 feet at Locations 1 through 30. Samples were taken at depths of 0 to 0.5 feet at Locations 31 through 33 and 51 through 60. The soil samples and analytical program were completed to define the spatial distribution of contamination, characterize contaminant source areas, provide samples for grain-size analyses, and select test boring locations. Augers were decontaminated (as described in the Quality Assurance Project Plan [QAPP]) between each sample collection to avoid cross-contamination and provide quality assurance. Results of the hand-auger samples, as well as data presented in Appendix E, are discussed in Section 5.5.

5.1.2 Borings

Nine borings for soil sampling (JTB-1 through JTB-9) were completed at the FTA site using 4.25-inch (ID), hollow-stem augers (Figure 5-1). Borings were terminated at the groundwater table surface, or about 34 feet below ground surface. Split-spoon soil samples were collected at 5-foot intervals to characterize the geology and subsurface contamination at the FTA site. Split-spoon samples were scanned with a photoionization (PI) meter during sample collection activities to determine whether VOCs were present. All soil samples were logged according to geologic characteristics, soil classification, and other observations (see the soil boring logs in Appendix B). Table 5-1 summarizes the drilling data for test borings and monitoring wells. All borings were backfilled with a cement/bentonite slurry upon completion. Split-spoons were decontaminated (as described in the QAPP) between each sample to avoid cross-contamination and to provide quality assurance. Results of the test boring samples are discussed in Section 5.5.



NOTES:

1, SAMPLES 31 AND 32 WERE TAKEN TO CHARACTERIZE BACKGROUND CONDITIONS.
2. PROFILE LOCATIONS A-A', B-B', AND C-C' ARE SHOWN ON FIGURES INCLUDED IN SECTION 5-4.
3. COMPOSITE SAMPLES ANALYZED FOR PCBs WERE COLLECTED FROM THE FOLLOWING HAND AUGER LOCATIONS

JCP-1	2, 3
JCP-2	9, 10
JCP-3	15, 16
JCP-4	19, 21
JCP-5	27, 30
JCP-6	32

FIGURE 5-1
HAND AUGER AND TEST BORING LOCATIONS
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

E.C.JORDAN CO.

5096-06

TABLE 5-1

SUMMARY OF BORING AND SAMPLE DATA
SUFFOLK COUNTY AIRPORT

Location	Total Depth[1]	Screened Interval[2]	Soil Samples: Split-spoon	Soil Samples: Reference	Soil Samples: Analytical	Water Samples
MW-101A	156	129-145	9[3]	5	0	2
101B	53	31-51	5	5	0	2
MW-102	51	28-48	11	9	2	2
MW-103	46	28-43	5	5	0	2
MW-104	116	75-90	11	11	0	2
MW-105	68	46-66	0	0	0	2
MW-106	53	34-49	0	0	0	2
MW-107A	151	132-148	20[3]	17	0	2
107B	104	85-100	9[3]	8	0	2
107C	53	29-49	0	0	0	2
P-1	44	27-37	0	0	0	0
P-2	43	31-41	0	0	0	0
P-3	73	51-65	0	0	0	1
P-4	46	39-44	0	0	0	0
JTB-1	36	--	7	3	4	--
JTB-2	36	--	7	3	4	--
JTB-3	36	--	7	3	4	--
JTB-4	36	--	7	3	4	--
JTB-5	36	--	7	3	4	--
JTB-6	36	--	7	5	2	--
JTB-7	36	--	7	5	2	--
JTB-8	36	--	7	5	2	--
JTB-9	36	--	7	5	2	--

Notes:

[1] All depths are in feet below ground and rounded to the nearest foot
[2] Screened intervals are rounded to the nearest foot
[3] Split spoon samples in which there was no recovery are not included as reference samples.

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5.2 SOILS

Surface soils at the FTA site consist of the Plymouth-Carver Association unit, which is a deep, well-drained, coarse-grained soil that occurs on nearly level and slightly undulating outwash plains. These soils formed over thick layers of stratified coarse sands and gravels which, with the exception of an occasional silt component, have very high hydraulic conductivities. Slopes of the formation generally range from 1 to 8 percent. This unit occurs over approximately 95 percent of the Suffolk County Airport and all of the FTA (Dames and Moore, 1986). Table 5-2 summarizes the physical properties of this soil unit. Nine grain-size analyses were performed on samples taken from the FTA site to further characterize surficial soils. Surface soils were found to be medium- to fine-grained sands. Grain-size distribution curves and sieve analysis data are shown in Appendix C.

5.3 GEOLOGY

The interpretation of the regional and local geologic conditions at the site is based on subsurface investigations, reconnaissance of the area, and the 1986 Dames and Moore report. Regional and local geology are presented in the following sections.

5.3.1 Regional Geology

The regional geology in the vicinity of the FTA site consists of five unconsolidated formations above the bedrock. Figure 5-2 illustrates the stratigraphic position of these formations. These units dip generally to the south and underlie the majority of Suffolk County. The metamorphic bedrock in the Long Island area consists of a hard, dense schist, gneiss, and granite. Bedrock is approximately 1,600 feet below ground surface. The Raritan Formation is located above the bedrock and consists of the Lloyd Sand and the Raritan Clay members, which are approximately 500 and 200 feet thick, respectively. Overlying this strata is the Magothy Formation, which is composed of fine to coarse sands with interstitial clay and is approximately 1,000 feet thick. The Monmouth Greensand, located above the Magothy Formation, is found approximately 3,000 feet south of the airport. This unit consists of silty and/or clayey sands, clay, and silt and may be up to approximately 100 feet thick. The Gardiners Clay, which may be up to 75 feet thick, is found directly beneath glacial deposits in the area.

The glacial deposits in the area consist primarily of glacial outwash, lacustrine or marine deposits, and glacial till (Figure 5-3). The primary glacial feature in the area is the Ronkonkoma Terminal Moraine, located approximately two miles north of the airport. The Harbor Hill Moraine, formed during a glacial readvance, is found along the northern portion of Long Island. These moraines represent the glacial high water mark, or the limit of glacial ice advance. Meltwater associated with these glacial events resulted in the glaciofluvial and glaciodeltaic deposits that underlie the airport. The upper glacial unit is composed primarily of sands and gravels with trace amounts of clayey glacial till and lacustrine clay (Dames and Moore, 1986).

TA[redacted]5-[redacted]

PHYSICAL PROPERTIES OF SOILS AT SUFFOLK COUNTY AIRPORT
WESTHAMPTON BEACH, NEW YORK

Properties	CbA - Carver (unit 10) Depth (inches) 0-22	22-60	P1B - Plymouth (unit 10) Depth (inches) 0-27	27-58
Texture	Fine to coarse sand	Coarse sand to gravelly sand	Loamy sand, loamy fine sand gravelly loamy sand, and sand	Sand and gravel, coarse sand, and gravelly coarse sand
Unified Soil Classification System	SP-SM, SW-SM	SP, SP-SM	SM, SP-SM	SP, GP, SP-SM, GP-GM
Percent Silt and Clay	5-10	0-10	5-25	0-10
Percolation Permeability (inches/hour)	>6.3	>6.3	>6.3	>6.3
Available Moisture Capacity (inches/inch)	0.03-0.04	0.02-0.04	0.04-0.08	0.02-0.04
pH reaction	4.5-5.5	4.5-5.5	4.5-5.5	4.5-5.5

SOURCE: Dames and Moore Phase I Report (1986)

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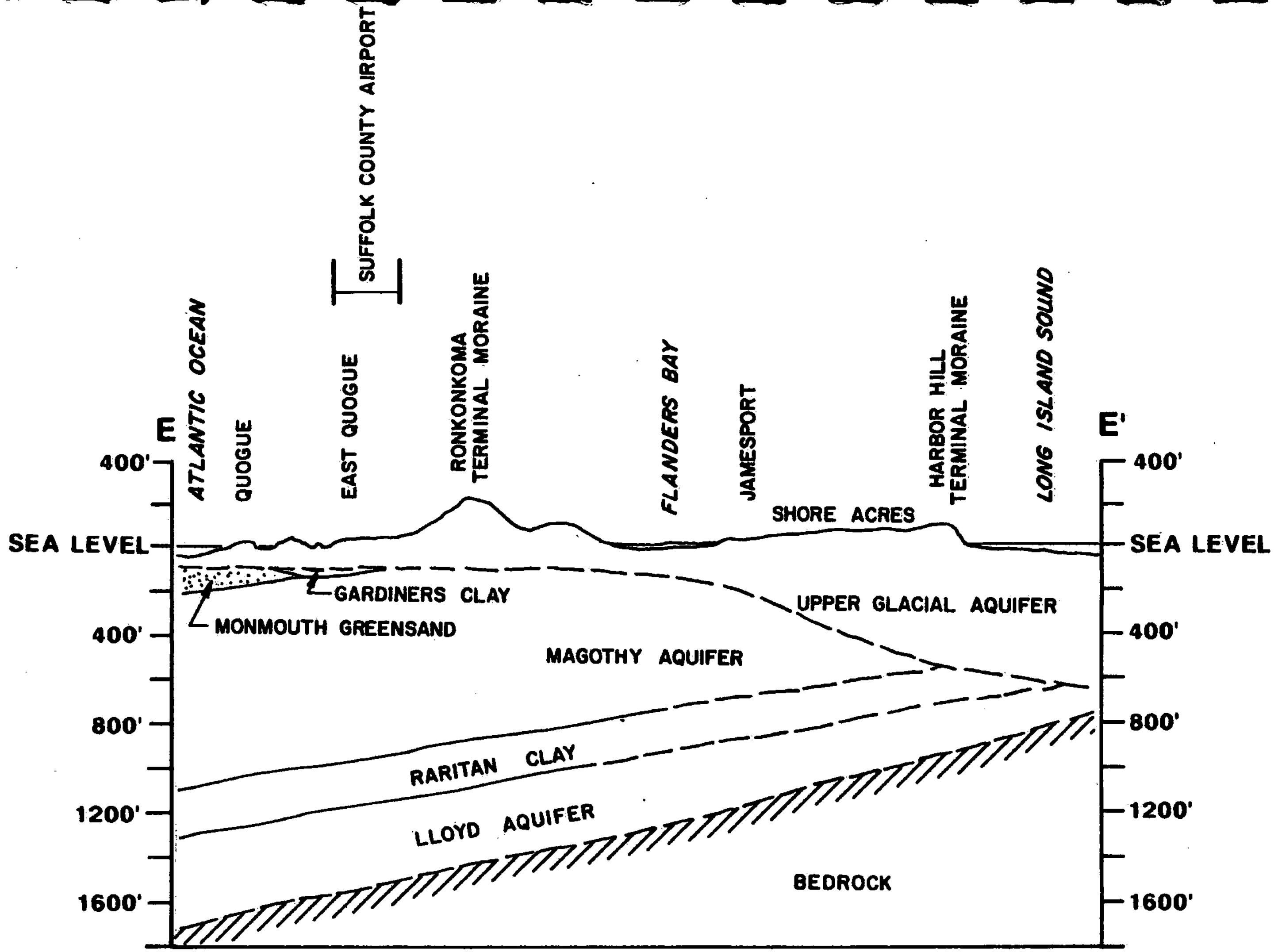

FIGURE 5-2
REGIONAL STRATIGRAPHY BENEATH
SUFFOLK COUNTY AIRPORT
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

SOURCE: HYDROGEOLOGY OF SUFFOLK COUNTY, LONG ISLAND, NEW YORK, U.S.G.S. PUBLICATION.

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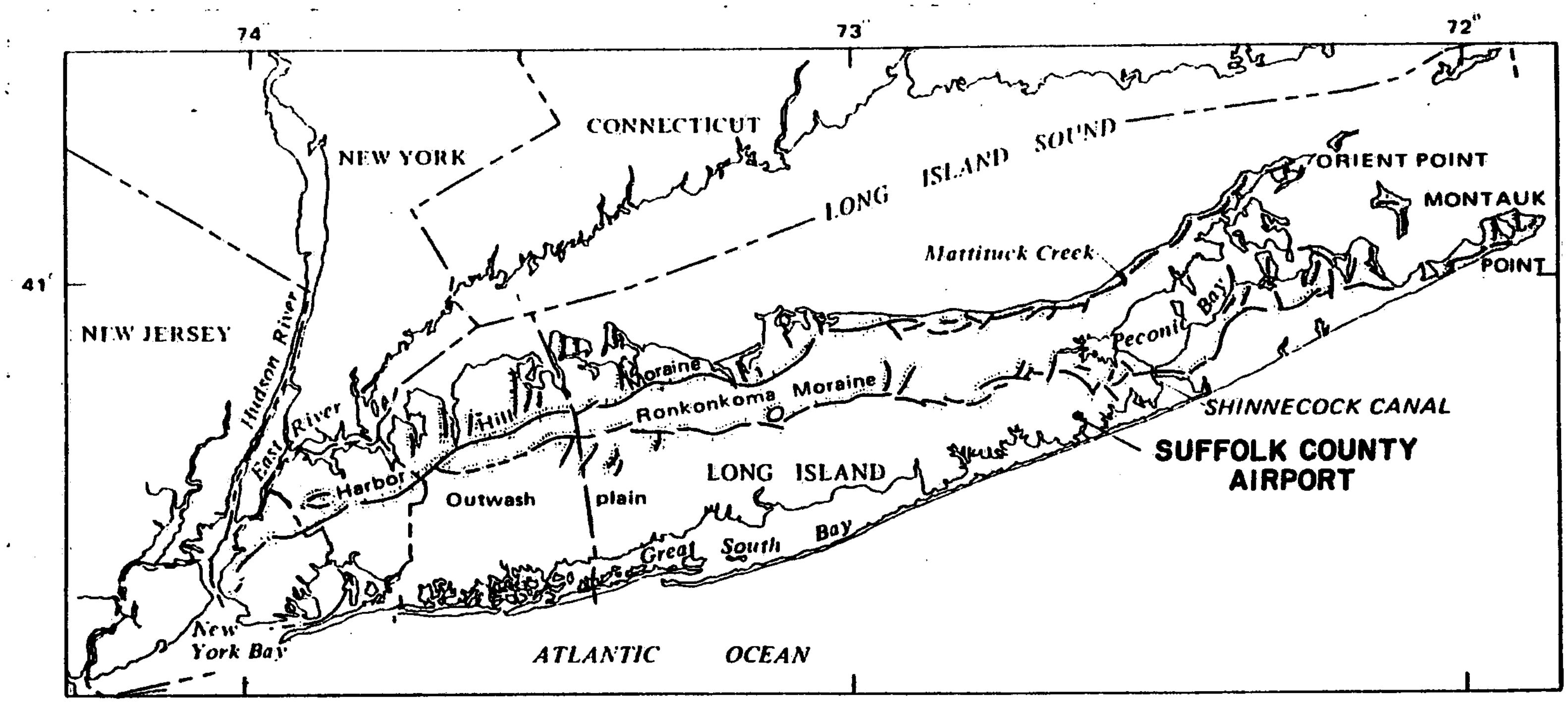

BASED ON U. S. GEOLOGICAL SURVEY, 1:250,000 SERIES:
SCRANTON, HARTFORD, 1962; NEW YORK, 1957;
NEWARK, PROVIDENCE, 1947

SCALE IN MILES

0 10 20 40

FIGURE 5-3
REGIONAL GEOLOGY MAP
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

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5.3.2 Local Geology

Fourteen monitoring wells were installed below the water table in the upper glacial deposits at the FTA site (MW-101 to MW-107 and P-1 to P-4). Locations of the borings are shown in Figure 5-4. These borings show that the local geology consists of stratified, current-bedded, fine to coarse sands and gravels. Wide variations in sorting and grading were observed and may be attributed to the alluvial nature of these deposits. However, no lithologic changes were observed in any of the shallow or deep holes. MW-101A and MW-107A were installed in an effort to characterize the Gardiners Clay, if the unit was present at depths within 150 feet of the ground surface. An interpretative geologic profile is shown in Figure 5-5.

Soil samples obtained from borings were observed to be tan to light brown or gray sands with trace amounts of gravel. A sample taken from MW-107A at 130 feet was observed to consist of gray, reddish-brown fine sands and gravels. The soils underlying the FTA site appear to become more dense at a depth of 100 feet; this may be attributed to limitations in sampling at that depth. Boring logs are contained in Appendix B.

5.4 SOIL SAMPLING

A total of 174 soil samples was collected at 54 locations to characterize the vertical and horizontal distribution of soil contamination. Samples were screened in the field for oil and grease and VOCs. Observations and measurements made in the field during sample collection are reported in Appendix D. Based on field screening results, a total of 102 soil samples was sent to CompuChem Laboratories, Inc., and analyzed for Hazardous Substance List (HSL) compounds (plus the 10 next highest peaks), lead, and oil and grease. USEPA Contract Laboratory Program (CLP) procedures were used to generate maximum quality data. Table 5-3 summarizes all the environmental sampling and corresponding laboratory analyses conducted for the site. Samples at locations JSS-31 and JSS-32 were selected as background samples. In the text of the report, soil sample concentrations are given in parts per million (ppm) units, and groundwater sample concentrations are given in parts per billion (ppb) units.

5.5 RESULTS OF CHEMICAL ANALYSES

This subsection presents a review of the chemical analyses. Chapter 11 identifies the significance of the contaminants in terms of risk to public health and the environment.

Soil samples were analyzed for oil and grease, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs) and lead. Results of soil sample analyses are discussed in the following sections. Figures 5-1 and 5-4 show locations of all explorations conducted at the site. Complete analytical results for soil samples are shown in Appendix E. In the discussions that follow, the information is presented as a series of three figures showing the distribution of a particular contaminant

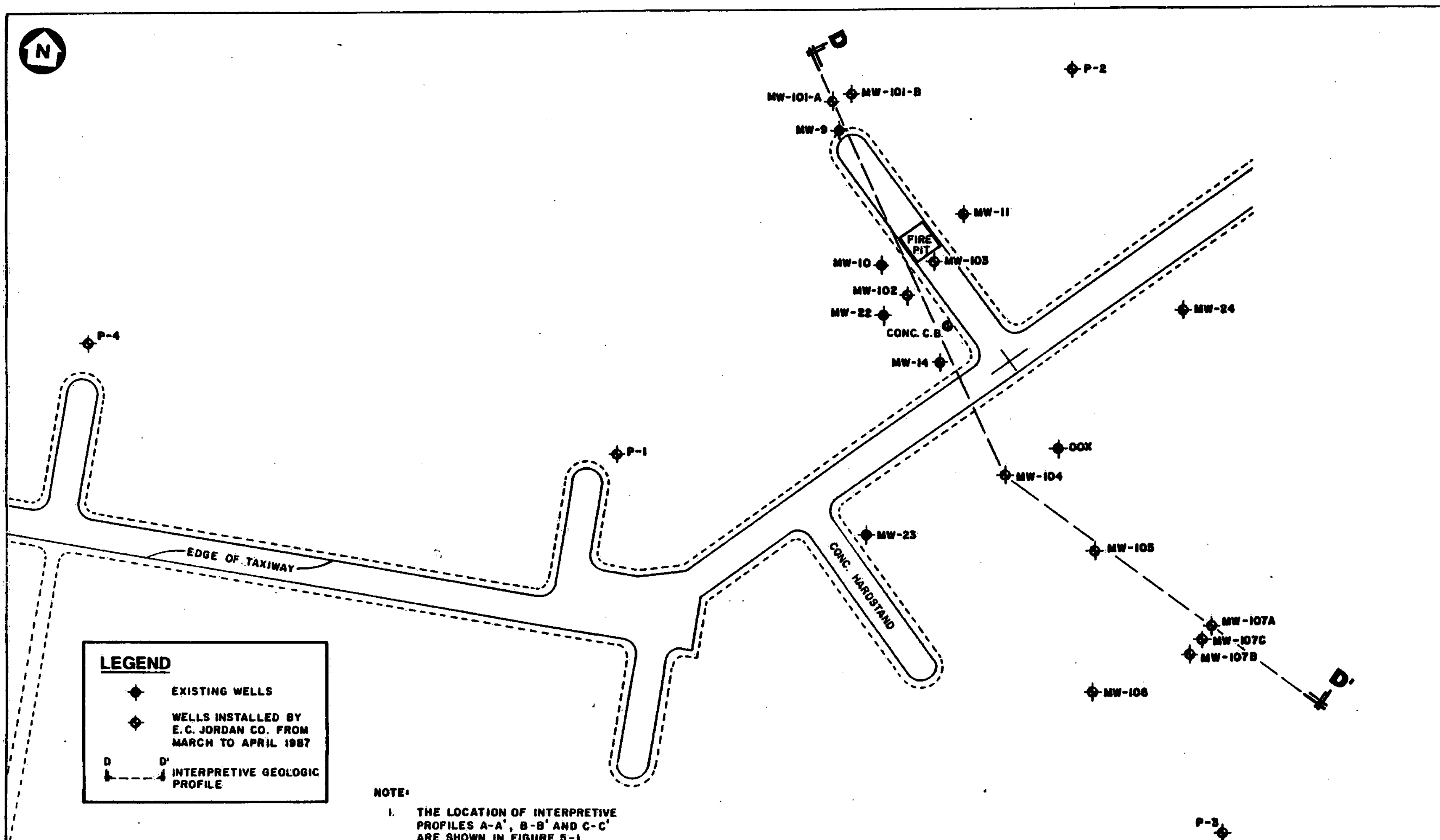

FIGURE 5-4
MONITORING WELL LOCATION MAP
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT
E.C.JORDAN CO.

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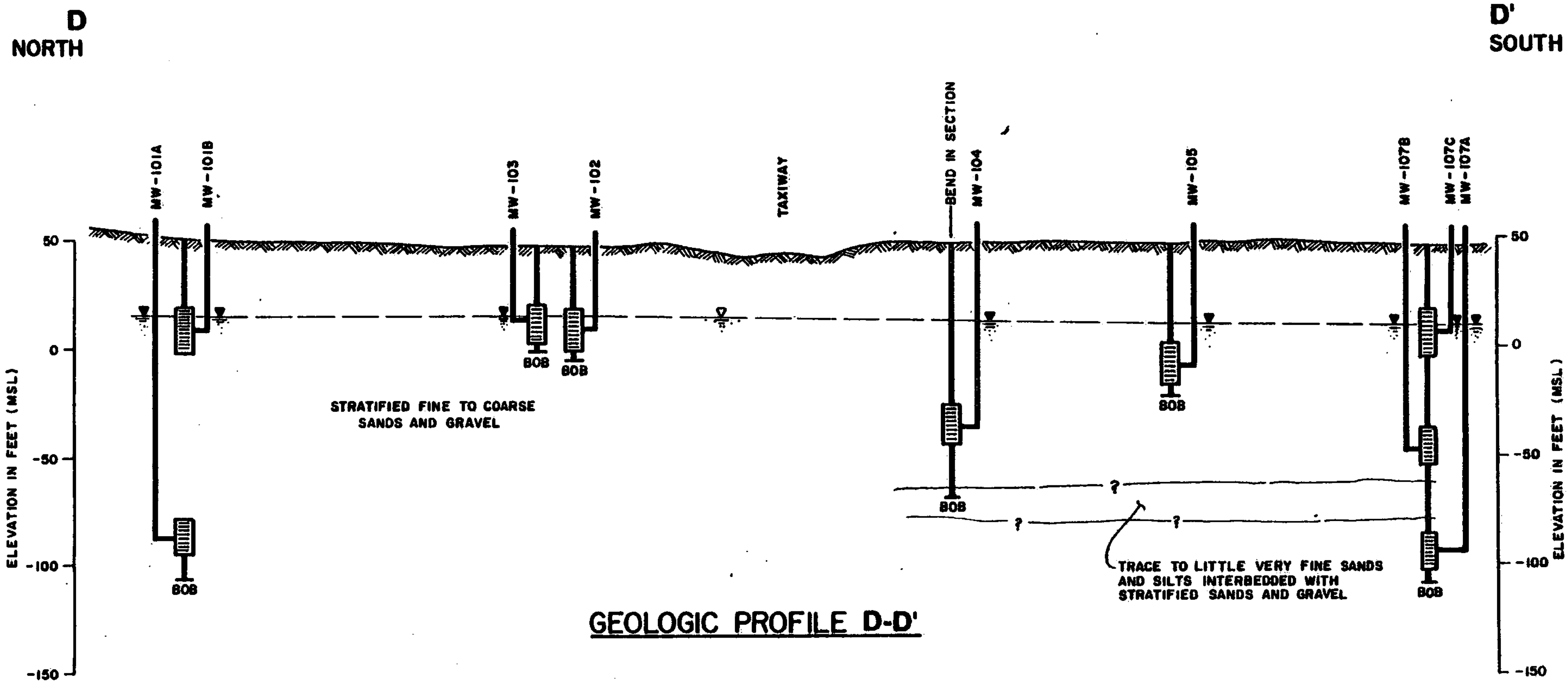
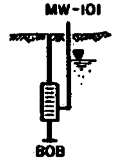


GEOLOGIC PROFILE D-D'

GEOLOGIC DESCRIPTION:
GLACIAL OUTWASH DEPOSITS OF STRATIFIED FINE TO COARSE SAND AND GRAVEL

LEGEND



MONITORING WELL LOCATION
GROUND SURFACE
OBSERVED WATER LEVEL (FEET, MSL) APRIL 1, 1987
WELL SCREEN
BOTTOM OF BORING

NOTES:

1. SEE FIGURE 5-4 FOR LOCATION AND ORIENTATION OF PROFILE.
2. EXPLORATIONS OFFSET FROM PROFILE D-D':

MW-101B	34 FEET NORTH
MW-103	42 FEET NORTH
MW-102	22 FEET SOUTH
MW-107B	26 FEET SOUTH
MW-107C	60 FEET SOUTH

3. PROFILES ARE BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE EXPLORATIONS. ACTUAL CONDITIONS BETWEEN EXPLORATIONS MAY VARY FROM THOSE SHOWN.

SCALE IN FEET
0 50 100 200
VERTICAL EXAGGERATION 2:1

FIGURE 5-5
INTERPRETIVE GEOLOGIC PROFILE D-D'
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

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TABLE 5-3

SUMMARY OF ENVIRONMENTAL SAMPLES
AND LABORATORY ANALYSES
SUFFOLK COUNTY AIRPORT FIRE TRAINING AREA

Environmental Media	Samples Taken and Screened	Samples for Laboratory Analyses: Lead	PCBs	VOCs	SVOCs	Pet. Hydro	Oil & Grease
Surface Soil (to 5 feet)	103	69	6	69	69	--	69
Subsurface Soil (Shallow Soil Borings)	63	31	--	31	31	8	31
Subsurface Soil (Monitoring Well Borings)	8	2	--	2	2	--	2
Tank Sample	1	--	--	--	--	--	--
Groundwater	21	21	--	21	21	21	--
Total Samples Taken	196						

Notes:

1. -- indicates no analysis

2. All soil samples were screened with a field gas chromatograph (GC)

3. Lead, PCBs, petroleum hydrocarbons, and oil and grease were analyzed according to EPA Contract Laboratory Program Caucus Inorganic Procedures (CLP CIP)

4. VOCs and SVOCs were analyzed according to EPA Contract Laboratory Program Caucus Organic Procedures (CLP COP).

based on sample analytical results at the surface, at a depth of 2 feet, and at a depth of 4 feet. One or more cross sections are also included showing the distribution of the contaminant based on the deeper boring soil sample analysis.

5.5.1 Lead

Results of soil sample analyses for lead are presented in Tables 5-4 and 5-5. A total of 102 shallow and deep soil samples was analyzed for lead at the FTA site. Lead was found above the method detection limits (10 ppm) in 74 soil samples. The highest concentrations of lead were in a sample of soil southwest of the burn containment area (360 ppm), and at a second location about 200 feet south of the FTA (148 ppm). Figure 5-6 illustrates the distribution of lead contamination in the surface soils. Figures 5-7 and 5-8 illustrate lead contamination in soils at depths of 2 and 4 feet below ground surface, respectively. Lead contamination was generally found at levels above 20 ppm at the center of the FTA site to a depth of 4 feet. In the immediate area surrounding the FTA, lead was detected at concentrations above 5 ppm to a depth of 4 feet.

Lead was found at concentrations between .56 ppm and 2.0 ppm at depths that range from 30 feet northeast and east of the FTA, to 20 feet in the southwestern portion of the FTA. Figures 5-9, 5-10, and 5-11 represent lead concentrations at depth along profiles A-A', B-B', and C-C', respectively. Profile locations shown in Figure 5-1 show that lead was not detected in high concentrations in deeper soils.

5.5.2 Oil and Grease

Results of oil and grease analyses are presented in Tables 5-6 and 5-7. Oil and grease were used as an indication of where areas of higher contamination exist. Oil and grease concentrations have no meaning in terms of risk to public health or the environment. A total of 102 shallow and deep soil samples was analyzed for oil and grease at the FTA site. Figure 5-12 illustrates the distribution of oil and grease contamination in surface soils at the FTA site. Oil and grease contamination was generally found at concentrations above 50 ppm in surficial soils throughout the entire FTA site. Figures 5-13 and 5-14 illustrate the distribution of oil and grease contamination in soils at depths of 2 and 4 feet below ground surface, respectively. Oil and grease contamination was found in surface soils at concentrations above 10,000 ppm at the center of the FTA site and approximately 200 feet south of the FTA.

Oil and grease contamination was found at concentrations up to 20,000 ppm at a depth of 2 feet below ground surface in the vicinity of the FTA and up to 27,000 ppm at an isolated area in the vicinity of SS-30. It was detected above 1,000 ppm at areas in the immediate vicinity of the FTA.

Oil and grease contamination above 1,000 ppm was found at depths 4 feet below ground surface in the vicinity of SS-17, and above 5,000 ppm at SS-30. At this depth, contamination was generally found above 50 ppm across the FTA.

Oil and grease contamination is present at concentrations above 50 ppm as deep as 35 feet below ground surface in the vicinity of the FTA. Figures 5-15,

TABLE 5-4

SUMMARY OF LEAD CONCENTRATIONS IN SHALLOW SOIL SAMPLES (ppm)
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

Soil Sample Location	Sample Depth (Feet) 0-0.5	1.5-2.0	3.5-4.0
JSS-1	14	--	--
JSS-2	18	--	--
JSS-4	5.9	.82	ND
JSS-6	4.7 (6.1 dup)	--	--
JSS-7	4.5	--	1
JSS-8	38	35	--
JSS-9	13	7.9	21
JSS-10	--	2	--
JSS-11	10	--	0.5
JSS-12	7.7	--	1.4
JSS-13	17 (19 dup)	--	6.9
JSS-14	12	--	--
JSS-15	6.1	--	--
JSS-16	12	--	1.3
JSS-17	39 (26 dup)	2.8	1.8
JSS-19	360*		
JSS-20	15 (25 Rep)*	16	--
JSS-21	--	29	4.0
JSS-22	8.1	--	0.74
JSS-24	13	--	--
JSS-25	5.4	--	0.70
JSS-26	25 (20 Rep)*	--	9.8
JSS-27	70 (88 dup)	4.6	--
JSS-28	148	5.0	--
JSS-29	27 (24 Rep)*	--	--
JSS-30	46 (47 Rep)*	13	3
JSS-31	10	--	--
JSS-32	7.8	--	--
JSS-33	128	--	--
JSS-51	16	--	--
JSS-52	14	--	--
JSS-53	6.1	--	--
JSS-54	7.7	--	--
JSS-55	3.6	--	--
JSS-56	8.7	--	--
JSS-57	7.7	--	--
JSS-58	23	--	--
JSS-59	7.3	--	--
JSS-60	24 (6.3 dup)	--	--

* = analysis performed by Oak Ridge National Laboratory; remaining analysis performed by CompuChem Laboratories.
JSS = 3, 5, 18, 23 were not analyzed in the laboratory.
-- = not analyzed.
dup = results of duplicate sample analyses.
Rep = results of replicate sample analyses.
ND = not detected

TABLE 5-5

SUMMARY OF LEAD CONCENTRATION IN DEEP SOIL SAMPLES (ppm)
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

Soil Sample	Depth (feet)						
Location	5.0	10	15	20	25	30	35
JTB-1	--	--	1.3	ND	--	7.9	.58
JTB-2	.51	--	--	1.4(1 Rep*)	--	1.2	ND
JTB-3	--	ND	ND	ND	--	--	ND
JTB-4	--	1.2	.62	--	.56	--	.73
JTB-5	--	2(2 Rep)*	1.1	.75	--	--	.53
JTB-6	--	2.1	--	--	--	2.0	--
JTB-7	--	--	ND	--	--	ND	--
JTB-8	--	--	1.4	--	--	ND	--
JTB-9	--	--	--	.61	--	--	ND
JMW-102 1501			ND				
2001				ND			

-- = not analyzed.
* Analyses performed by Oak Ridge National Laboratory; remaining analyses performed by CompuChem Laboratory.
Rep = Results of replicate analyses (required for CLP quality control).
ND = Not Detected

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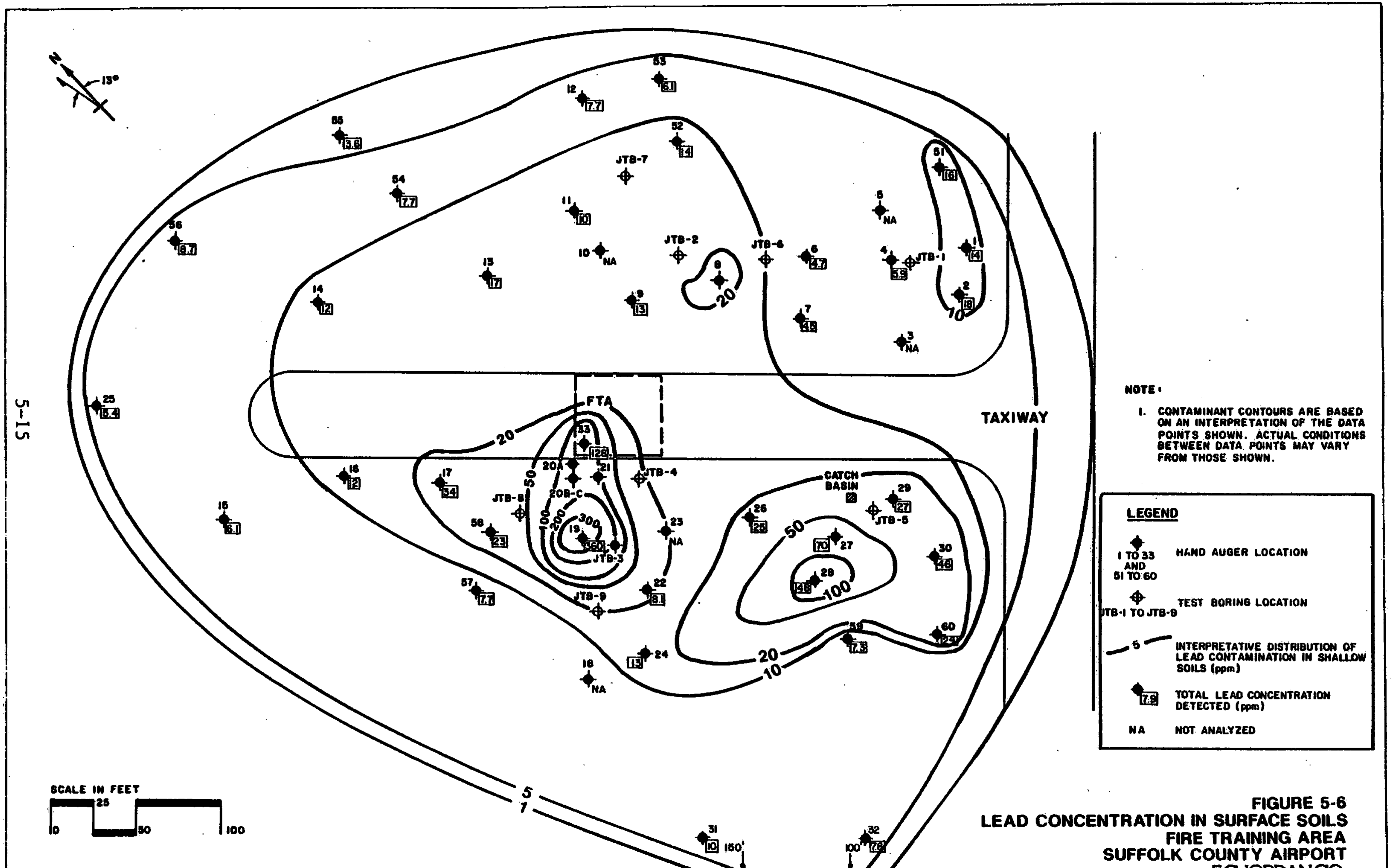

FIGURE 5-6
LEAD CONCENTRATION IN SURFACE SOILS
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

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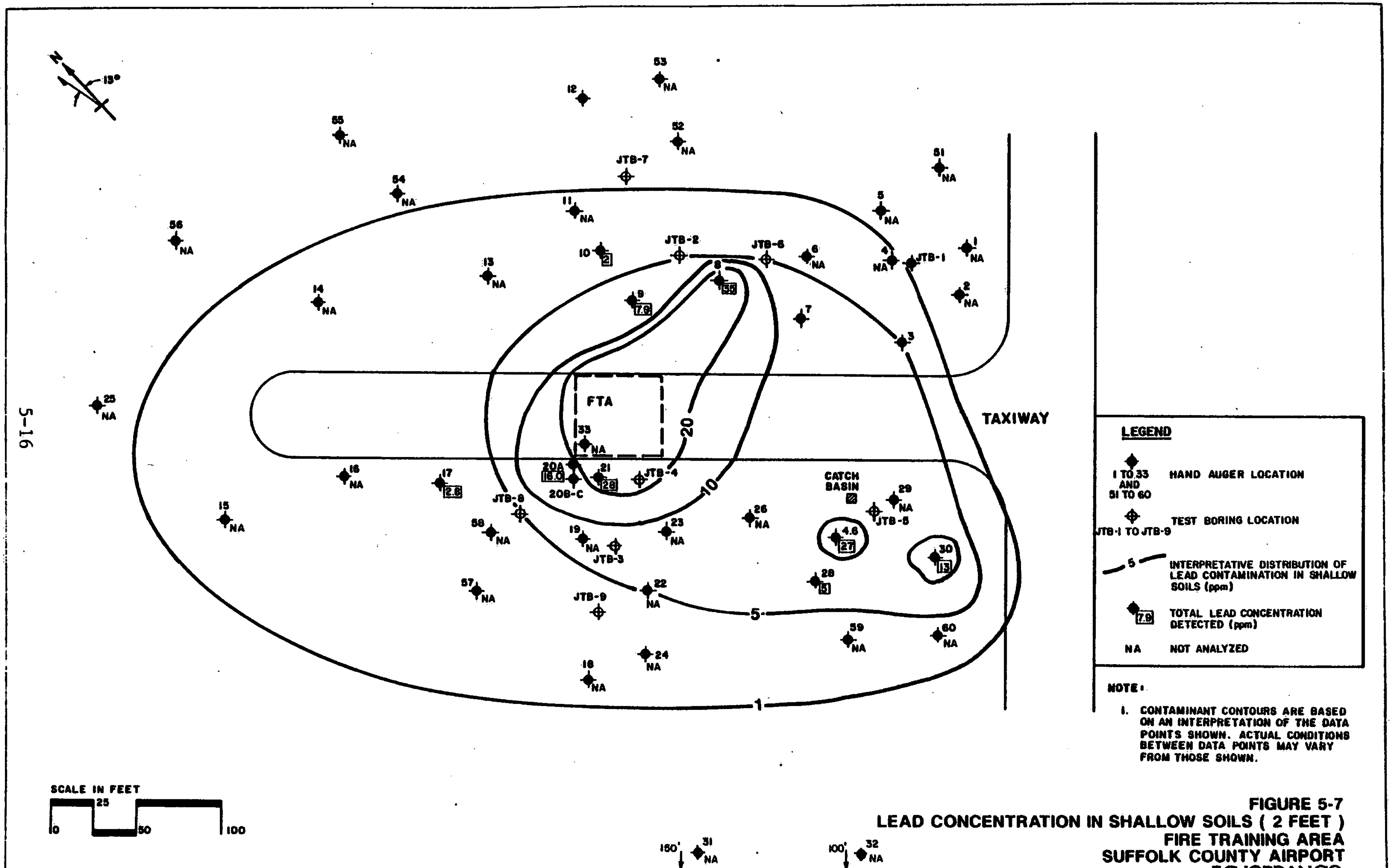

FIGURE 5-7
LEAD CONCENTRATION IN SHALLOW SOILS (2 FEET)
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT
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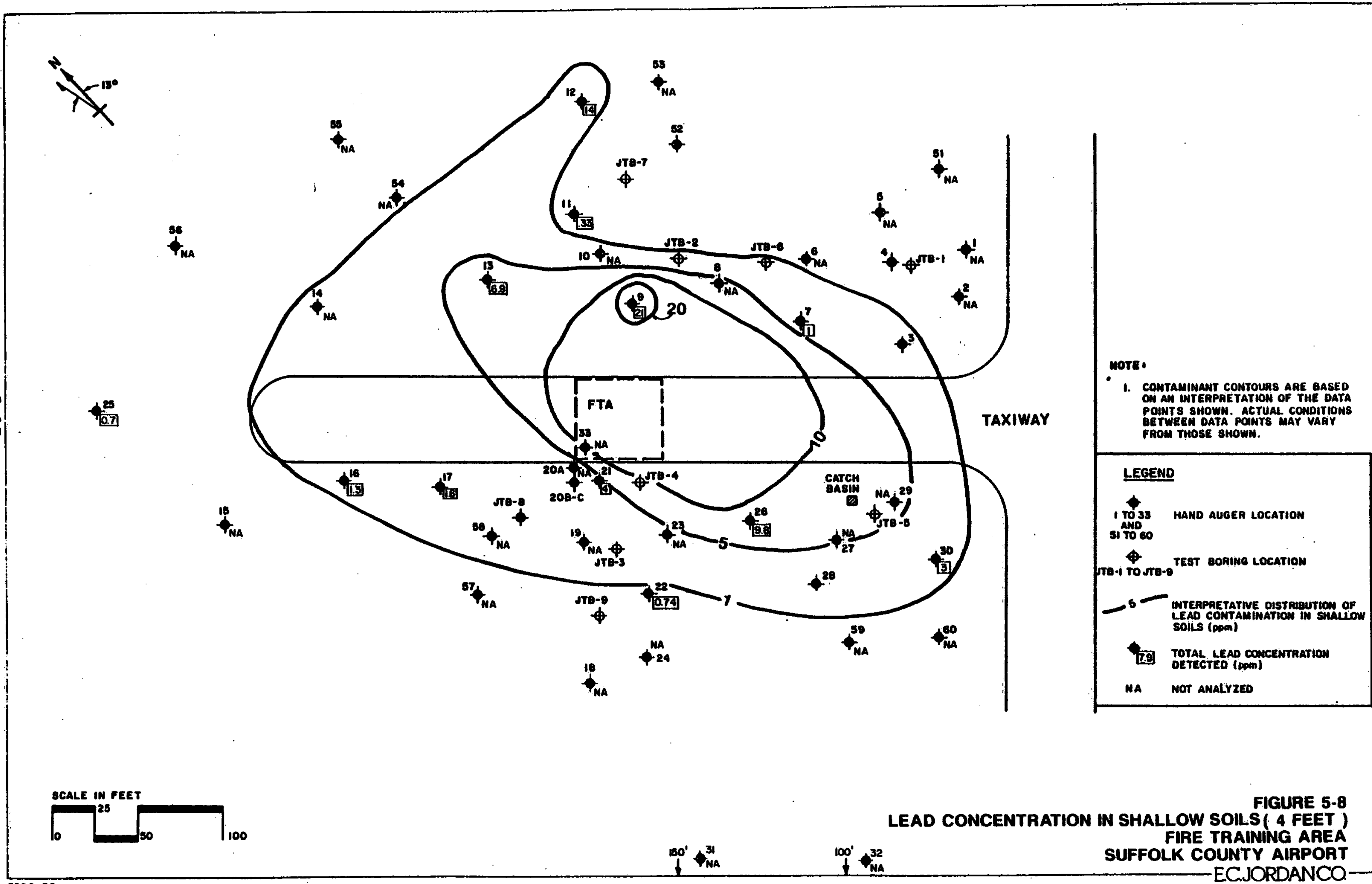

FIGURE 5-8
LEAD CONCENTRATION IN SHALLOW SOILS (4 FEET)
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT
E.C.JORDAN CO.

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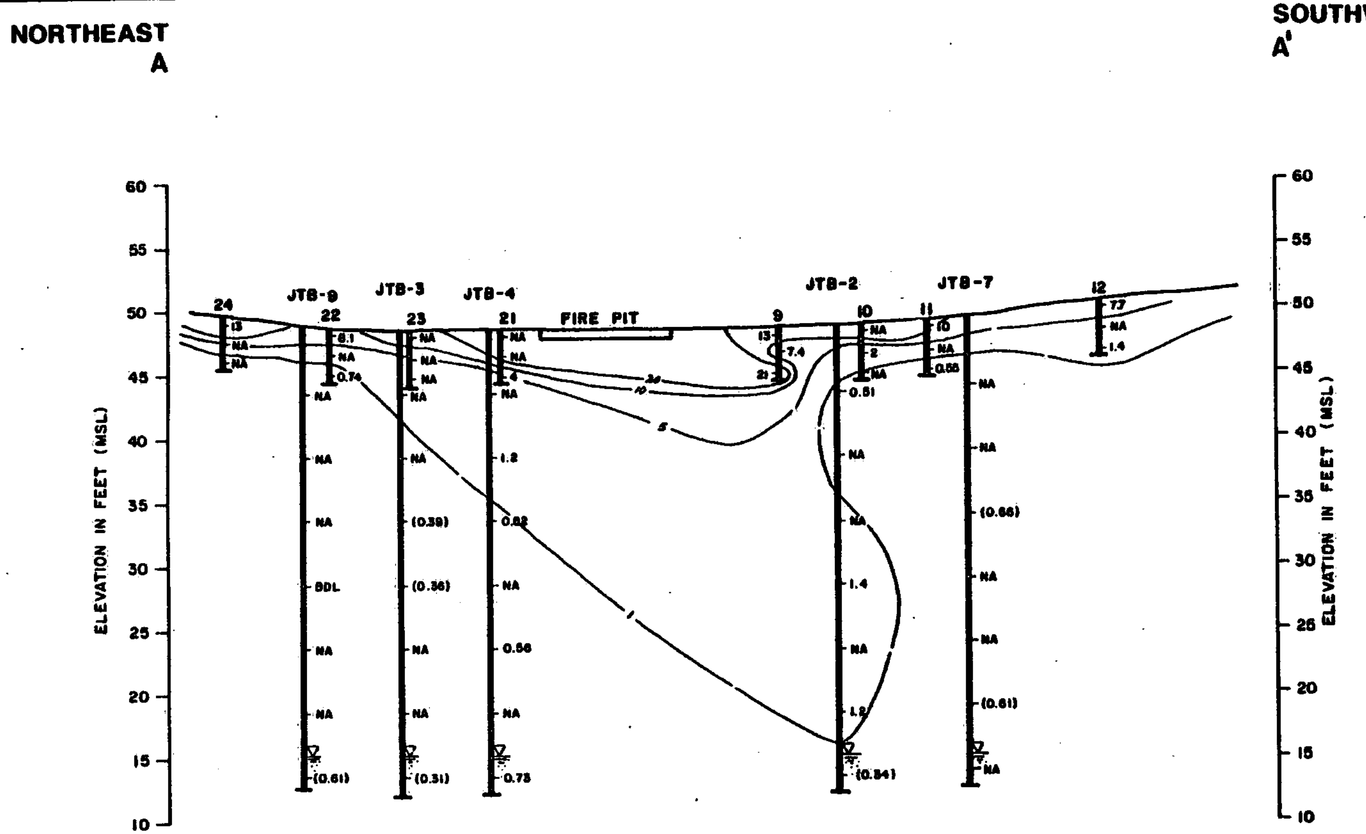

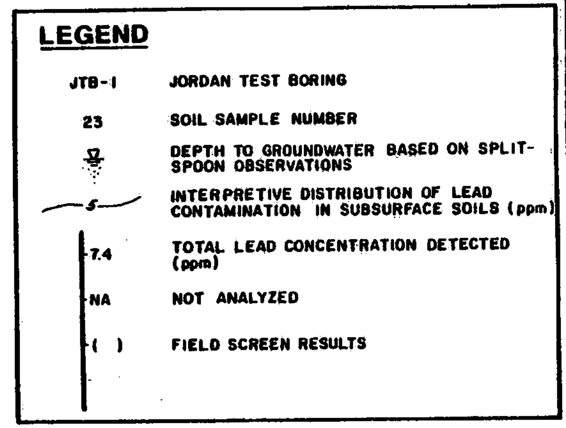

NOTES:

1. SEE FIGURE 5-1 FOR HORIZONTAL LOCATION OF SOIL BORINGS AND TEST BORINGS.
2. SEE FIGURE 5-1 FOR LOCATION AND ORIENTATION OF PROFILE A-A'
3. CONTAMINANT CONCENTRATION CONTOURS ARE BASED ON DATA POINTS TAKEN AT 5-FOOT DEPTH INTERVALS. ACTUAL CONCENTRATIONS AT DEPTH MAY VARY FROM THOSE SHOWN.

SCALE IN FEET
0 25 50 100
VERTICAL EXAGGERATION 5:1

FIGURE 5-9
VERTICAL DISTRIBUTION OF
LEAD CONTAMINATION IN SOILS
AT PROFILE A-A'
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

E.C.JORDAN CO.

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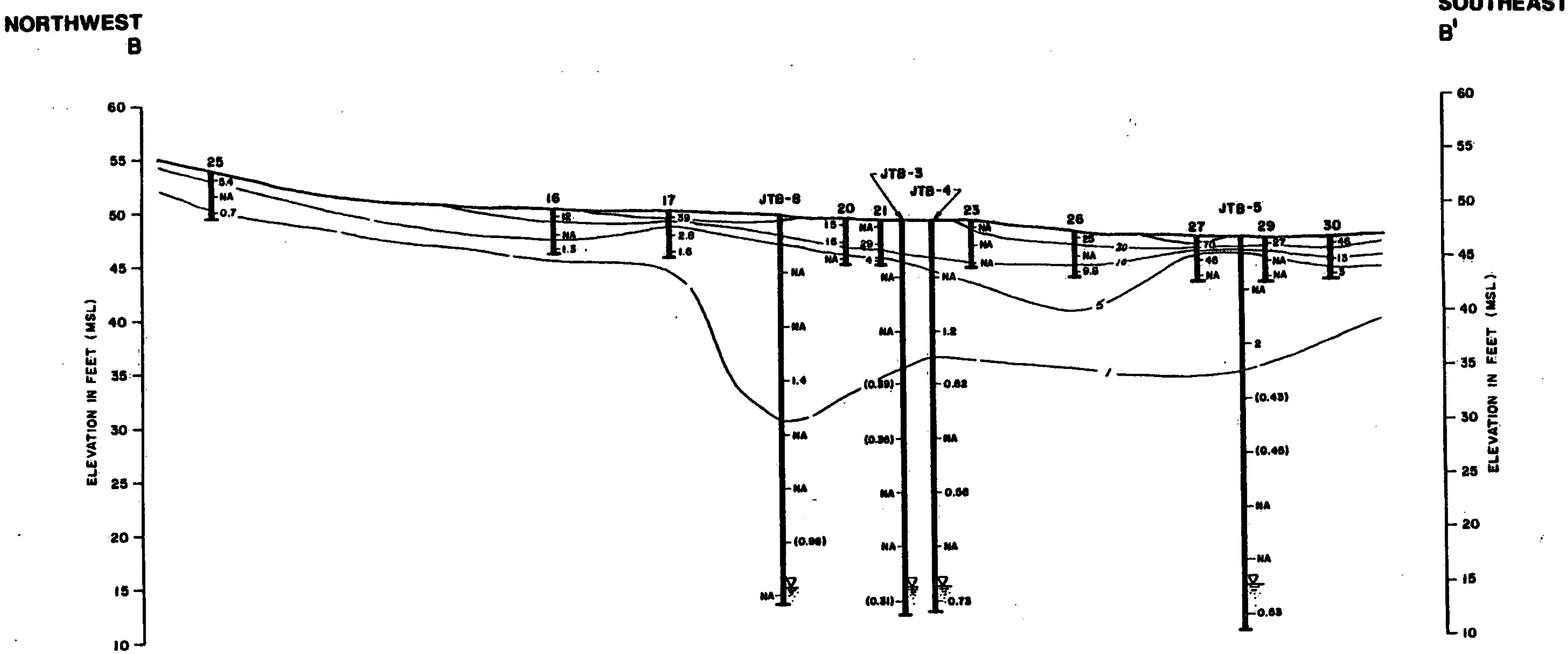

LEGEND

JTB-1	JORDAN TEST BORING
23	SOIL SAMPLE NUMBER
▽	DEPTH TO GROUNDWATER BASED ON SPLIT-SPOON OBSERVATIONS
5	INTERPRETIVE DISTRIBUTION OF LEAD CONTAMINATION IN SUBSURFACE SOILS (ppm)
7.4	TOTAL LEAD CONCENTRATION DETECTED (ppm)
NA	NOT ANALYZED
( )	FIELD SCREEN RESULTS

NOTES:

1. SEE FIGURE 5-1 FOR HORIZONTAL LOCATION OF SOIL BORINGS AND TEST BORINGS.
2. SEE FIGURE 5-1 FOR LOCATION AND ORIENTATION OF PROFILE B-B'.
3. CONTAMINANT CONCENTRATION CONTOURS ARE BASED ON DATA POINTS TAKEN AT 5-FOOT DEPTH INTERVALS. ACTUAL CONCENTRATIONS AT DEPTH MAY VARY FROM THOSE SHOWN.

SCALE IN FEET
0 25 50 100
VERTICAL EXAGGERATIONS 5:1

FIGURE 5-10
VERTICAL DISTRIBUTION OF LEAD CONTAMINATION IN SOILS AT PROFILE B-B'
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

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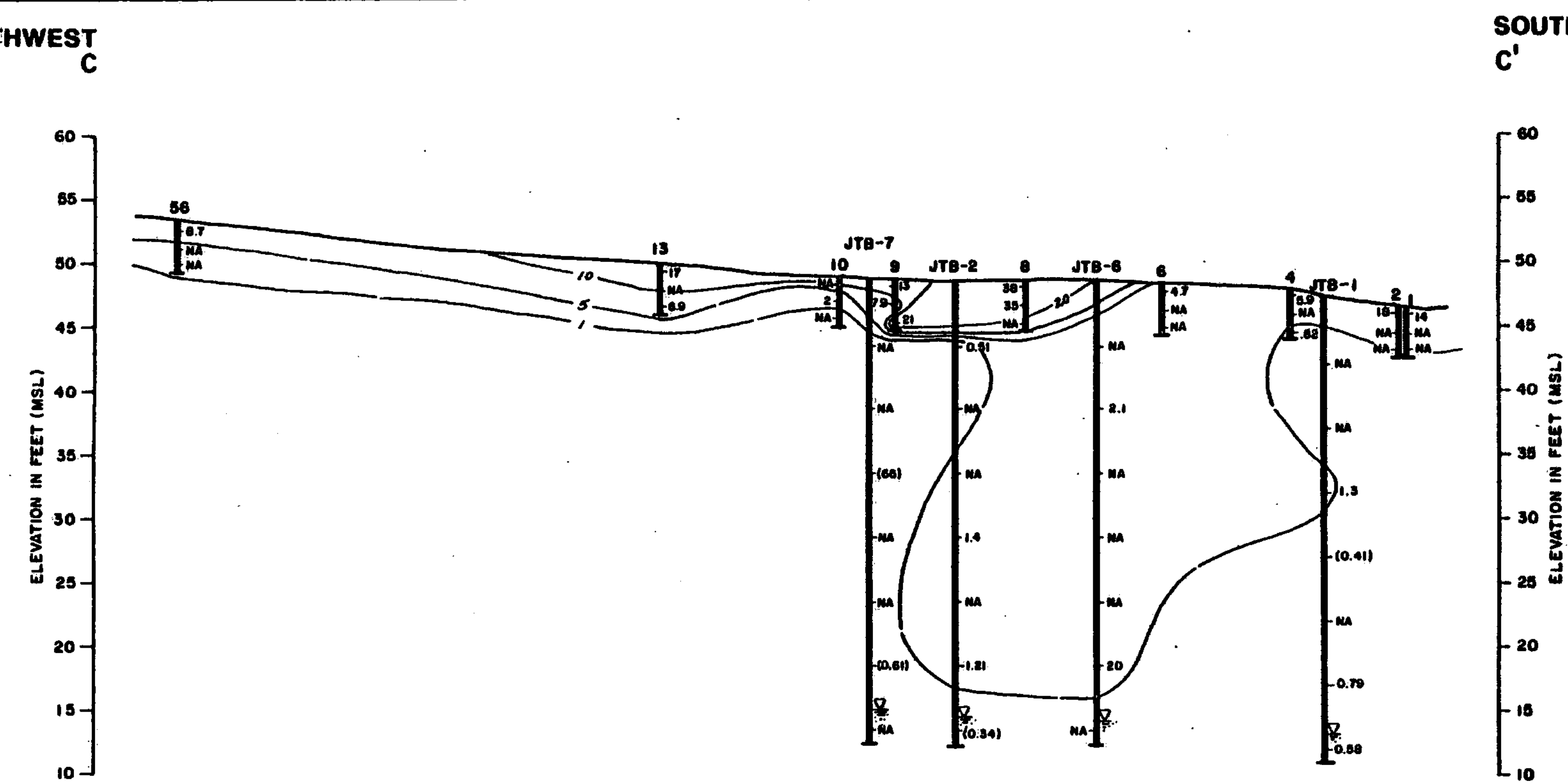

LEGEND

JTB-1	JORDAN TEST BORING
23	SOIL SAMPLE NUMBER
	DEPTH TO GROUNDWATER BASED ON SPLIT-SPOON OBSERVATIONS
5	INTERPRETIVE DISTRIBUTION OF LEAD CONTAMINATION IN SUBSURFACE SOILS (ppm)
7.4	TOTAL LEAD CONCENTRATION DETECTED (ppm)
NA	NOT ANALYZED
( )	FIELD SCREEN RESULTS

NOTES:

1. SEE FIGURE 5-1 FOR HORIZONTAL LOCATION OF SOIL BORINGS AND TEST BORINGS.
2. SEE FIGURE 5-1 FOR LOCATION AND ORIENTATION OF PROFILE C-C.
3. CONTAMINANT CONCENTRATION CONTOURS ARE BASED ON DATA POINTS TAKEN AT 5-FOOT DEPTH INTERVALS. ACTUAL CONCENTRATIONS AT DEPTH MAY VARY FROM THOSE SHOWN.

SCALE IN FEET
0 25 50 100
VERTICAL EXAGGERATION 5:1

FIGURE 5-11
VERTICAL DISTRIBUTION OF LEAD CONTAMINATION IN SOILS AT PROFILE C-C'
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

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TABLE 5-6

SUMMARY OF OIL AND GREASE CONTAMINATION IN SHALLOW SOIL SAMPLES (ppm)
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

Soil Sample Location	0-0.5	1.5-2.0	3.5-4.0
JSS-1	120	--	--
JSS-2	320	--	--
JSS-4	1,900	--	520
JSS-6	8,100 (5,800 dup)	--	--
JSS-7	2,000	--	6,400
JSS-8	26,000	680	--
JSS-9	21,000	1,000	6,300
JSS-10	--	360	--
JSS-11	23,000	--	34
JSS-12	52	--	--
JSS-13	6,200 (6,700 dup)	--	110
JSS-14	150	--	--
JSS-16	62	--	--
JSS-17	16,000 (11,000 dup)	20,000	1,600 (1,500 dup)
JSS-20	8,100	19,000	--
JSS-21	--	19,000	1,500
JSS-22	160	--	--
JSS-24	36	--	--
JSS-25	170	--	--
JSS-26	1,600	--	200
JSS-27	120 (550 dup)	130	--
JSS-28	18,000	280	--
JSS-29	240	--	--
JSS-30	26,000	27,000	8,500
JSS-31	76	--	--
JSS-32	240	--	--
JSS-33	49,000	--	--
JSS-51	72	--	--
JSS-52	590	--	--
JSS-53	36	--	--
JSS-54	190	--	--
JSS-55	42	--	--
JSS-56	170	--	--
JSS-57	69	--	--
JSS-58	89	--	--
JSS-59	74	--	--
JSS-60	40 (19 dup)	--	--

dup = results of duplicate analysis
-- = not analyzed
JSS 3, 5, 15, 18, 19 and 23 were not analyzed in the laboratory.

TABLE 5-7

SUMMARY OF OIL AND GREASE CONTAMINATION IN DEEP SOIL SAMPLES (ppm)
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

Soil Sample Location	Depth (feet)						
	5	10	15	20	25	30	35
JTB-1	--	--	--	--	--	--	--
JTB-2	26	--	--	9,000	--	6,500	450
JTB-3	--	410	4,300	4,200	--	--	--
JTB-4	--	1,900	3,400	--	25	--	27
JTB-5	--	240	26	--	--	--	25
JTB-6	--	3,500 TPH	--	--	--	160 TPH	--
JTB-7	--	--	--	--	--	--	--
JTB-8	--	--	140 TPH (40 TPH, dup)	--	--	--	--
JTB-9	--	--	--	--	--	--	33 TPH

-- = Field screened but not analyzed
TPH = Total petroleum hydrocarbons

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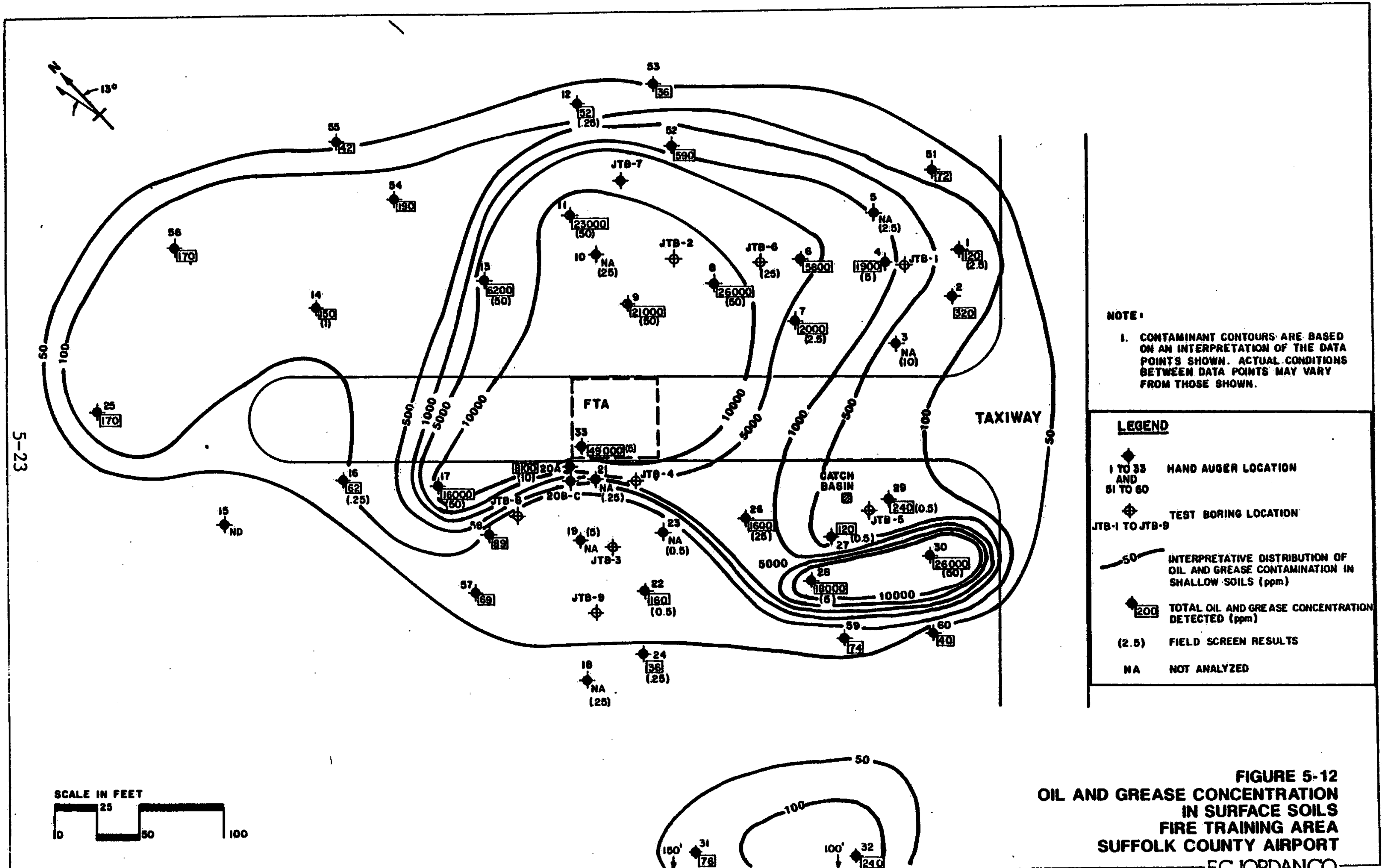

FIGURE 5-12
OIL AND GREASE CONCENTRATION IN SURFACE SOILS
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

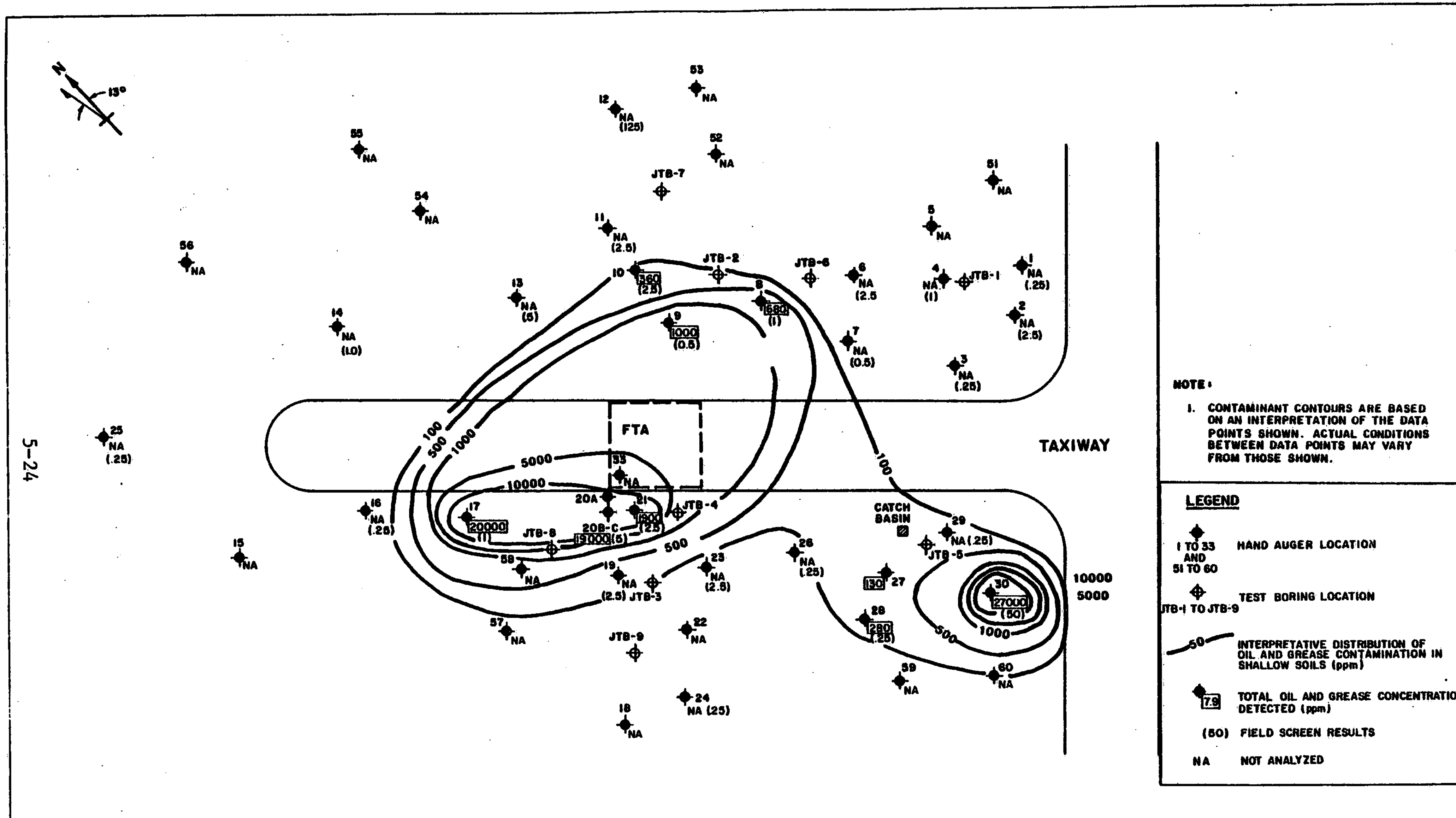

FIGURE 5-13
OIL AND GREASE CONCENTRATION
IN SHALLOW SOILS (2 FEET)
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

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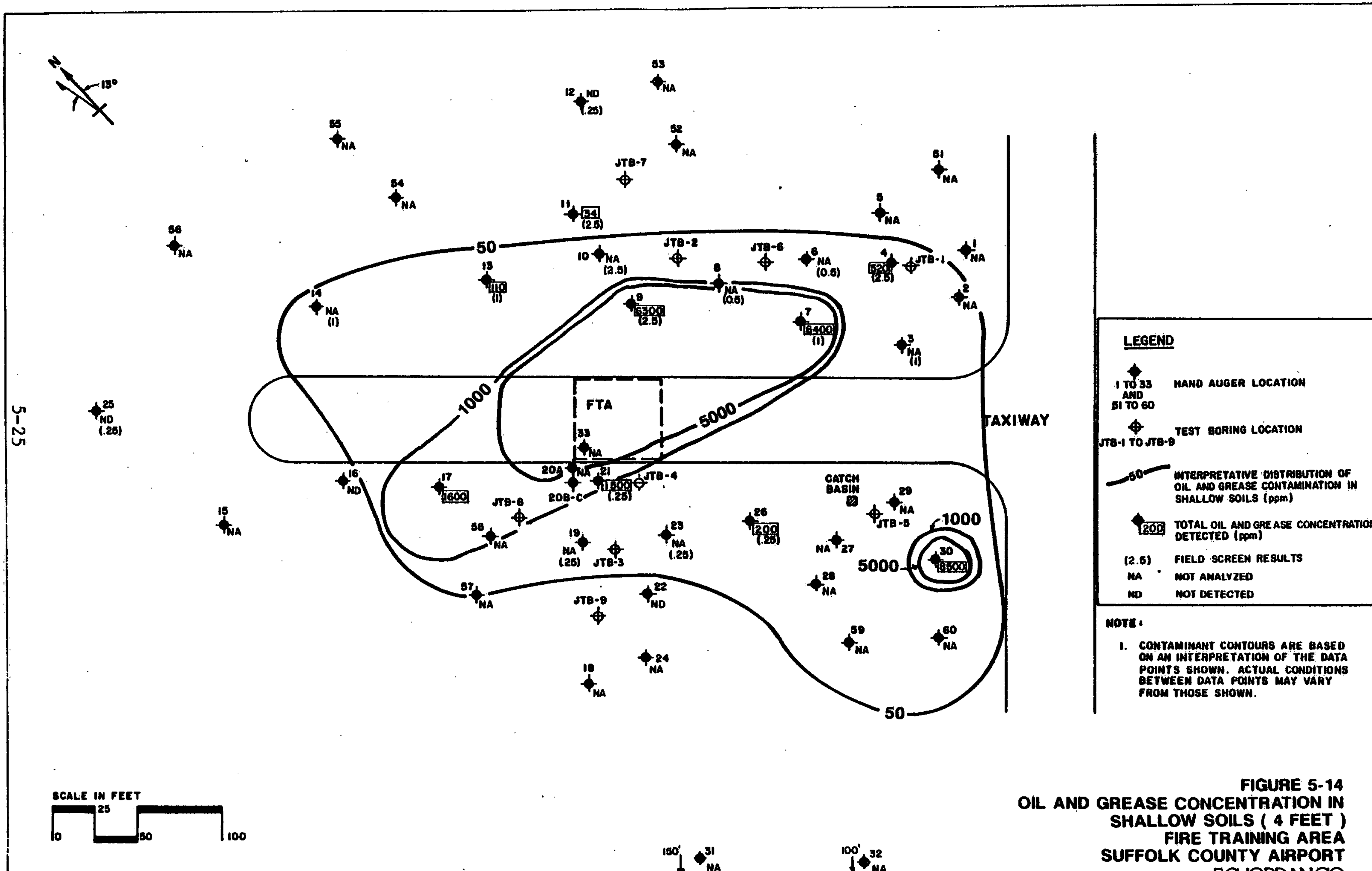

5-25

FIGURE 5-14
OIL AND GREASE CONCENTRATION IN SHALLOW SOILS (4 FEET)
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

E.C.JORDAN CO.

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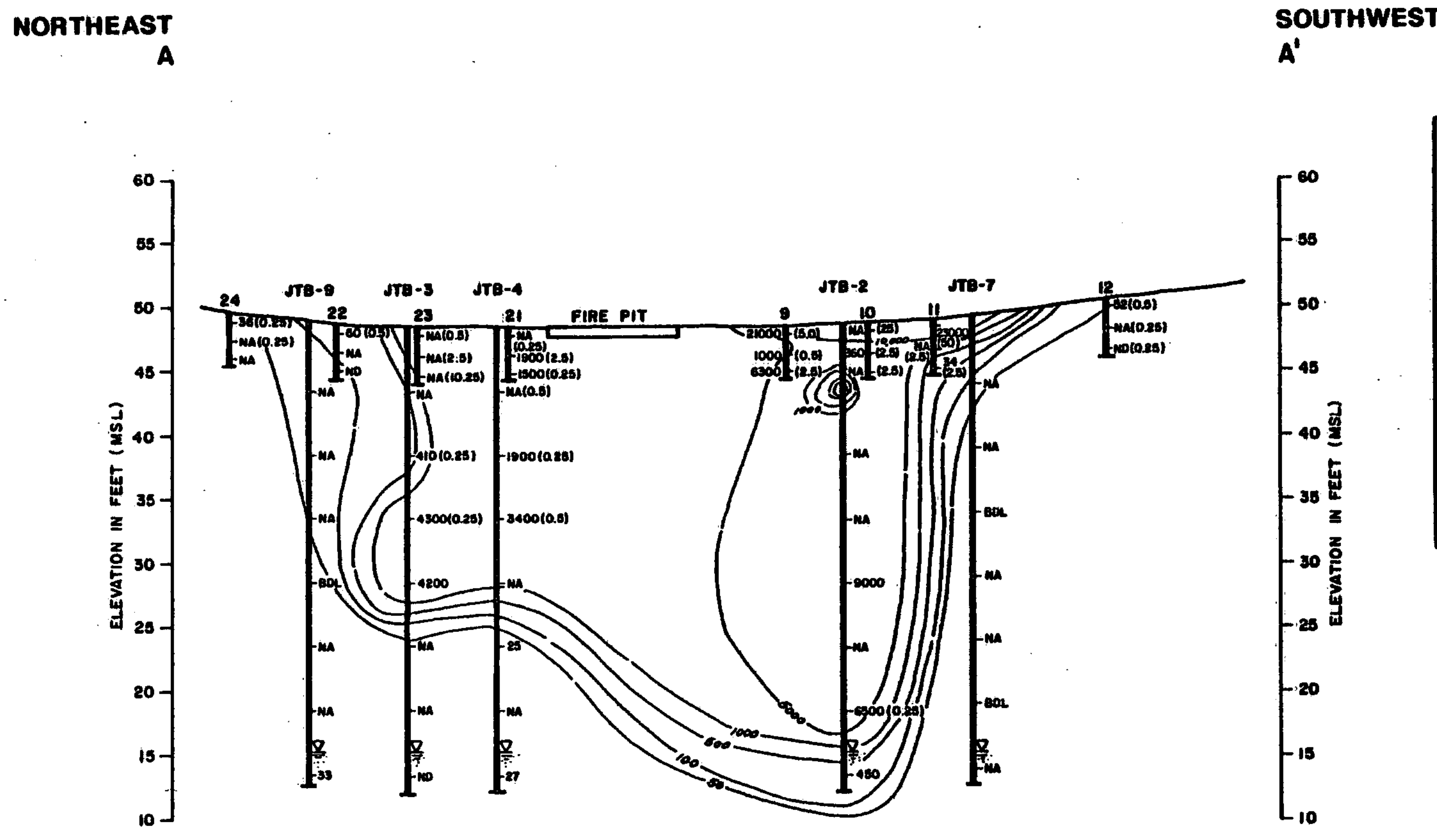

LEGEND

JTB-1	JORDAN TEST BORING
23	SOIL SAMPLE NUMBER
	DEPTH TO GROUNDWATER BASED ON SPLIT-SPOON OBSERVATIONS
5	INTERPRETIVE DISTRIBUTION OF OIL AND GREASE CONTAMINATION IN SUBSURFACE SOILS (ppm)
27	TOTAL OIL AND GREASE CONTAMINATION DETECTED (ppm)
(0.5)	FIELD SCREEN RESULTS
NA	NOT ANALYZED
BDL	BELOW DETECTION LIMIT

NOTES:

1. SEE FIGURE 5-1 FOR HORIZONTAL LOCATION OF SOIL BORINGS AND TEST BORINGS
2. SEE FIGURE 5-1 FOR LOCATION AND ORIENTATION OF PROFILE A-A'.
3. CONTAMINANT CONCENTRATION CONTOURS ARE BASED ON DATA POINTS TAKEN AT 5-FOOT DEPTH INTERVALS. ACTUAL CONCENTRATIONS AT DEPTH MAY VARY FROM THOSE SHOWN.

SCALE IN FEET
0 25 50 100
VERTICAL EXAGGERATION 5:1

FIGURE 5-15
VERTICAL DISTRIBUTION OF OIL AND GREASE CONTAMINATION IN SOILS AT PROFILE A-A'
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

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5-16, and 5-17 represent oil and grease concentrations at depth along profiles A-A', B-B', and C-C', respectively. Profile locations are shown in Figure 5-1.

5.5.3 Organics

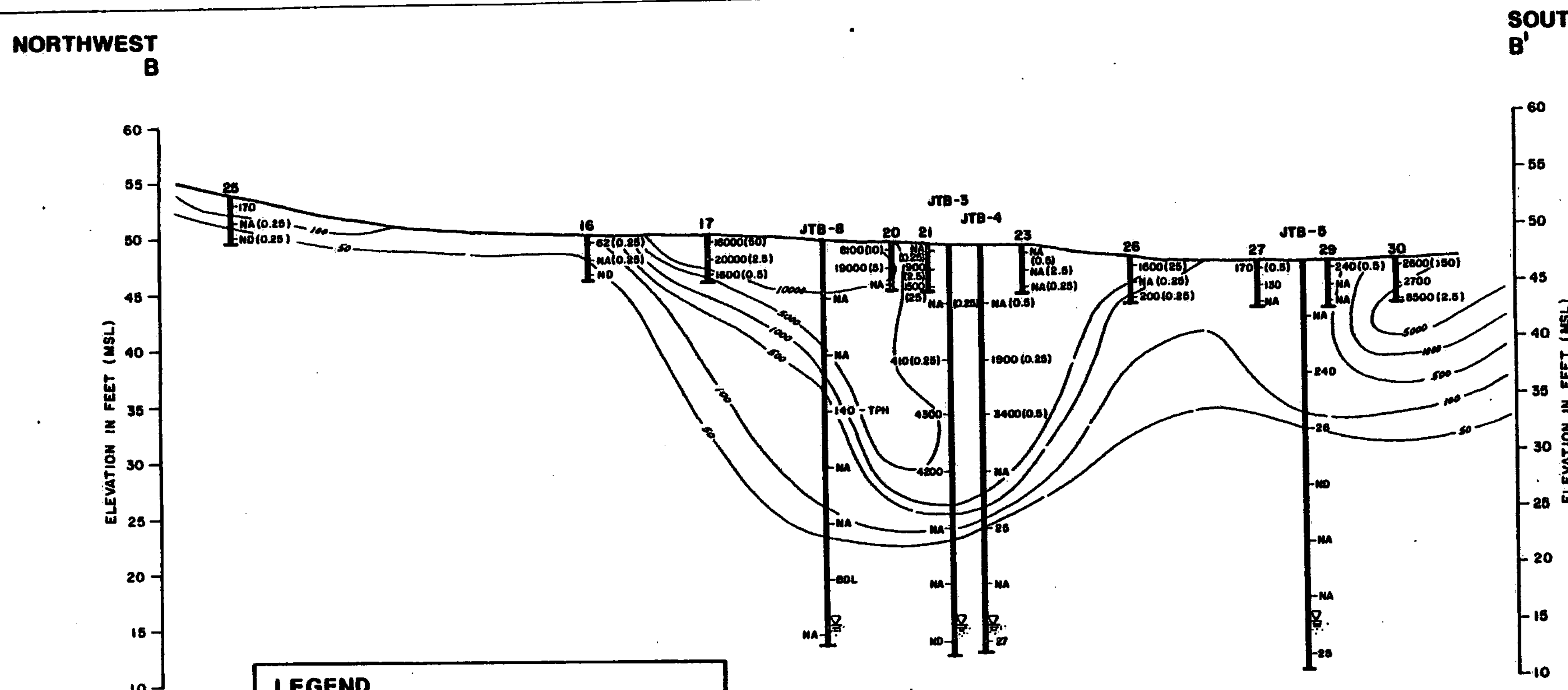
Of the 102 soil samples collected, only ten contained detectable levels of VOCs. Table 5-8 summarizes the concentrations of VOCs and SVOCs found at the site. Although sparse, the distribution of VOCs is similar to that of metals and oil and grease; the highest VOC concentrations were found near the FTA center and at JTB-2 (Figure 5-18). VOCs were detected at three shallow soil sample locations and in seven soil samples taken from test borings at the FTA site. Figures 5-19 and 5-20 illustrate VOC contamination at depth along profiles A-A' and C-C', respectively.

The most common VOCs found in soils were xylenes and ethylbenzene. Benzene, toluene, tetrachloroethene, and chlorobenzene were also detected at the FTA site; however, the summed concentrations were less than .2 ppm at the center of the FTA (JSS-21, JSS-33, and JSS-20) and at JTB-2, JTB-4, and JTB-5.

SVOCs were detected in 14 soil samples. SVOCs are located primarily in the vicinity of the FTA at the center of the site and east of the FTA. The distribution of SVOCs is presented in Figure 5-21. The most common SVOCs present were PNAs. These compounds are frequently found in or formed by incomplete combustion of fossil fuels. The maximum total PNA detected was 12.2 ppm in JTB-2; the maximum single compound PNA detected was benzo(a)anthracene at 9.6 ppm in JTB-2. Phenols were detected at JTB-2 (4.7 ppm) and JTB-3 (1 ppm). Phthalate was detected at JSS-28 (.35 ppm) and JTB-4 (.51 ppm). Figures 5-22 and 5-23 illustrate SVOC contamination at depth.

5.5.4 PCBs

Six soil samples (JCP-1 to JCP-6) were analyzed for PCBs/Pesticides. JCP-1 to JCP-6 refer to composite soil samples which were taken from soil samples located in Figure 5-1. PCBs were not detected in any samples. Pesticides were not detected in any soil samples, with the exception of .031 ppm of 4,4-DDT in JCP-4.



LEGEND

JTB-1	JORDAN TEST BORING
23	SOIL SAMPLE NUMBER
	DEPTH TO GROUNDWATER BASED ON SPLIT-SPOON OBSERVATIONS
5	INTERPRETIVE DISTRIBUTION OF OIL AND GREASE CONTAMINATION IN SUBSURFACE SOILS (ppm)
27	TOTAL OIL AND GREASE CONTAMINATION DETECTED (ppm)
(0.5)	FIELD SCREEN RESULTS
NA	NOT ANALYZED
ND	NOT DETECTED

NOTES:

1. SEE FIGURE 5-1 FOR HORIZONTAL LOCATION OF SOIL BORINGS AND TEST BORINGS
2. SEE FIGURE 5-1 FOR LOCATION AND ORIENTATION OF PROFILE B-B'
3. CONTAMINANT CONCENTRATION CONTOURS ARE BASED ON DATA POINTS TAKEN AT 5-FOOT DEPTH INTERVALS. ACTUAL CONCENTRATIONS AT DEPTH MAY VARY FROM THOSE SHOWN.

SCALE IN FEET
0 25 50 100
VERTICAL EXAGGERATION 5:1

FIGURE 5-16
VERTICAL DISTRIBUTION OF OIL AND GREASE CONTAMINATION IN SOILS AT PROFILE B-B'
SUFFOLK COUNTY AIRPORT
FIRE TRAINING AREA

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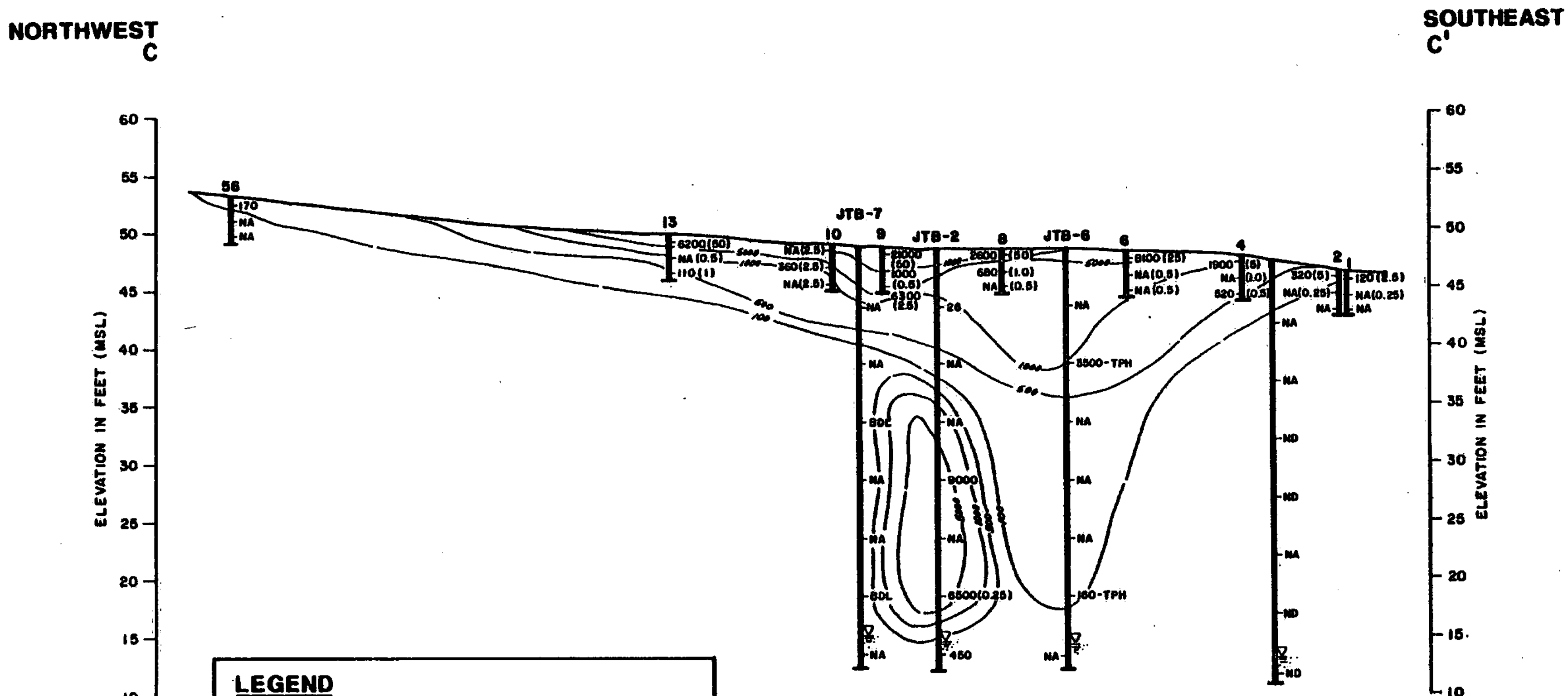

LEGEND

JTB-1	JORDAN TEST BORING
23	SOIL SAMPLE NUMBER
	DEPTH TO GROUNDWATER BASED ON SPLIT-SPOON OBSERVATIONS
5	INTERPRETIVE DISTRIBUTION OF OIL AND GREASE CONTAMINATION IN SUBSURFACE SOILS (ppm)
27	TOTAL OIL AND GREASE CONTAMINATION DETECTED (ppm)
(0.5)	FIELD SCREEN RESULTS
NA	NOT ANALYZED
ND	NOT DETECTED

NOTES:

1. SEE FIGURE 5-1 FOR HORIZONTAL LOCATION OF SOIL BORINGS AND TEST BORINGS
2. SEE FIGURE 5-1 FOR LOCATION AND ORIENTATION OF PROFILE C-C'
3. CONTAMINANT CONCENTRATION CONTOURS ARE BASED ON DATA POINTS TAKEN AT 5-FOOT DEPTH INTERVALS. ACTUAL CONCENTRATIONS AT DEPTH MAY VARY FROM THOSE SHOWN.

SCALE IN FEET
0 25 50 100
VERTICAL EXAGGERATION 5:1

FIGURE 5-17
VERTICAL DISTRIBUTION OF OIL AND GREASE CONTAMINATION IN SOILS AT PROFILE C-C'
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

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TABLE 5-8

SUMMARY OF VOLATILE AND SEMIVOLATILE ORGANIC CHEMICALS IN SOIL SAMPLES (ppm)
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

Volatile Organic Compounds	Location/Depth (feet) JSS-4 .5	JSS-6 .5	JSS-11 .5	JSS-13 .5	JSS-20 .5	JSS-21 2.0	JSS-28 .5	JSS-33 .5	JTB-2 20	JTB-2 30	JTB-2 35	JTB-3 15	JTB-3 20	JTB-4 10	JTB-4 15	JTB-5 15
Xylenes	--	--	--	--	.091	.069	--	--	2.8	.68	--	2.4	.95	.044	.29	--
Benzene	--	--	--	--	--	.009	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	--	--	--	--	--	.008	--	--	.1	.035	--	--	--	--	--	--
Tetrachloroethene	--	--		--	--	--	--	--	.037	--	--	--	--	--	--	.038*
Toluene	--	--	--	--	--	.066	--	.13	.092	--	--	--	--	--	.012	--
Chlorobenzene	--	--	--	--	.02*	--	--	--	--	--	--	--	--	--	--	--
<u>Semivolatile Organic Compounds</u>																
Polynuclear Aromatics	.73	5.03 (4.3 dup)	1.82	2.5 (.88 dup)	3.1 (2.5 Rep)*	9.0	--	5.7	9.6	12.2	1.6	--	--	.43	8.26	--
Phenols	--	--	--	--	--	--	--	--	--	4.7	--	--	1	--	--	--
Phthalate	--	--	--	--	--	--	.35	--	--	--	--	--	--	.51	--	--
N-Phenylamine	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.59	--
Dibenzofuran	--	--	--	--	.73*	--	--	--	--	--	--	--	--		.43	--

-- = Not Detected
* Analytical analyses performed by Oak Ridge National Laboratory; remaining analysis performed by CompuChem Laboratory.
Samples were analyzed at other locations but no VOCs or SVOCs were present above detection limits.

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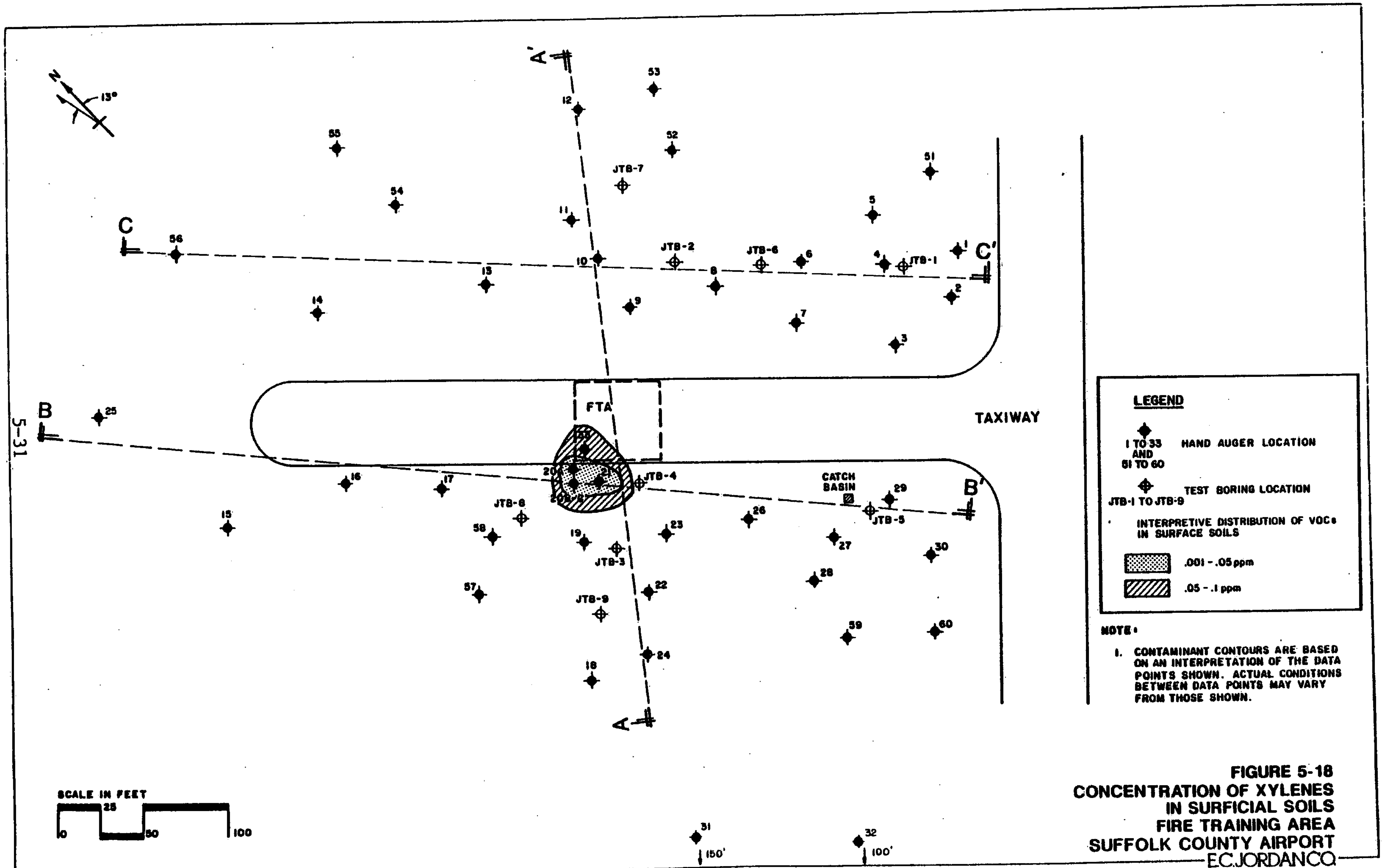

FIGURE 5-18
CONCENTRATION OF XYLENES
IN SURFICIAL SOILS
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

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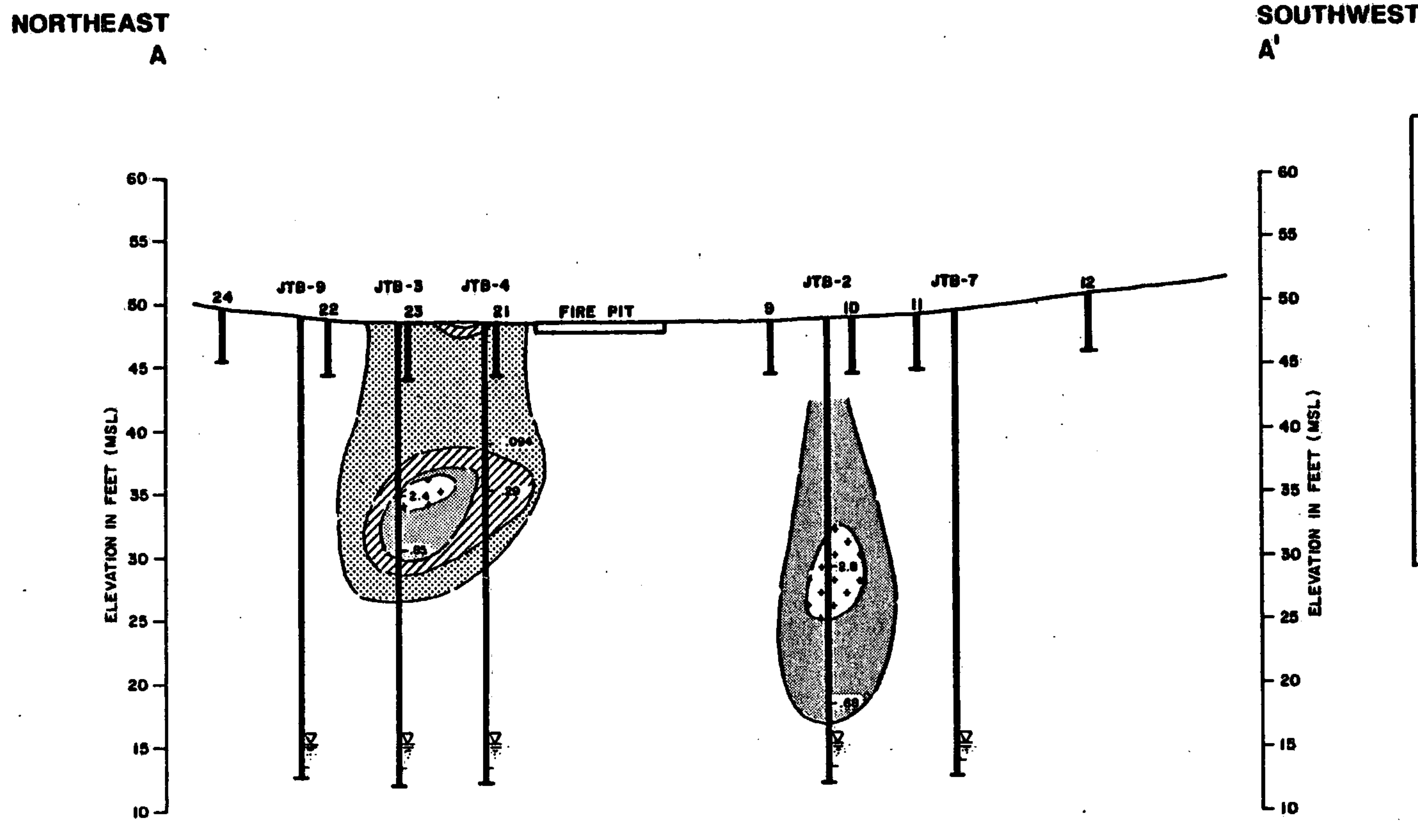

LEGEND

JTB-1	JORDAN TEST BORING
23	SOIL SAMPLE NUMBER
∇	DEPTH TO GROUNDWATER BASED ON SPLIT-SPOON OBSERVATIONS

INTERPRETIVE DISTRIBUTION OF VOCs IN SUBSURFACE SOILS

- .05 - .1 ppm
- .1 - .5 ppm
- .5 - 1 ppm
- >1 ppm

NOTES:

1. SEE FIGURE 5-18 FOR HORIZONTAL LOCATION OF SOIL BORINGS AND TEST BORINGS
2. SEE FIGURE 5-18 FOR LOCATION AND ORIENTATION OF PROFILE A-A'.
3. CONTAMINANT CONCENTRATION CONTOURS ARE BASED ON DATA POINTS TAKEN AT 5-FOOT DEPTH INTERVALS. ACTUAL CONCENTRATIONS AT DEPTH MAY VARY FROM THOSE SHOWN.

SCALE IN FEET

0 25 50 100

VERTICAL EXAGGERATION 5:1

FIGURE 5-19
VERTICAL DISTRIBUTION OF XYLENES
IN SOILS AT PROFILE A-A'
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

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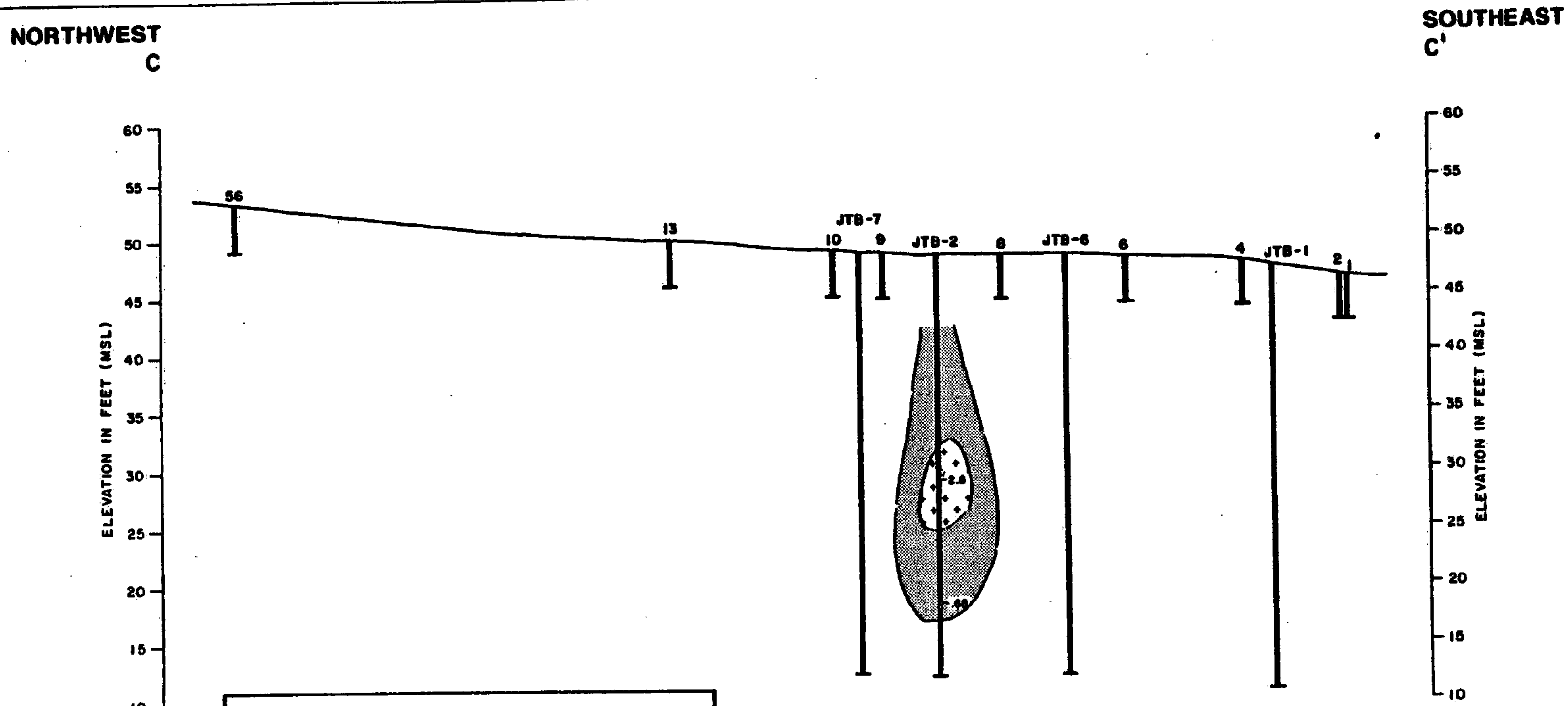

LEGEND

JTB-1	JORDAN TEST BORING
23	SOIL SAMPLE NUMBER
	DEPTH TO GROUNDWATER BASED ON SPLIT-SPOON OBSERVATIONS

INTERPRETIVE DISTRIBUTION OF VOCs IN SUBSURFACE SOILS

- .05 - .1 ppm
- .1 - .5 ppm
- .5 - 1 ppm
- >1 ppm

NOTES:

1. SEE FIGURE 5-18 FOR HORIZONTAL LOCATION OF SOIL BORINGS AND TEST BORINGS
2. SEE FIGURE 5-18 FOR LOCATION AND ORIENTATION OF PROFILE C-C'.
3. CONTAMINANT CONCENTRATION CONTOURS ARE BASED ON DATA POINTS TAKEN AT 5-FOOT DEPTH INTERVALS. ACTUAL CONCENTRATIONS AT DEPTH MAY VARY FROM THOSE SHOWN.

SCALE IN FEET

0 25 50 100

VERTICAL EXAGGERATION 5:1

FIGURE 5-20
VERTICAL DISTRIBUTION OF XYLENES IN SOILS AT PROFILE C-C'
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

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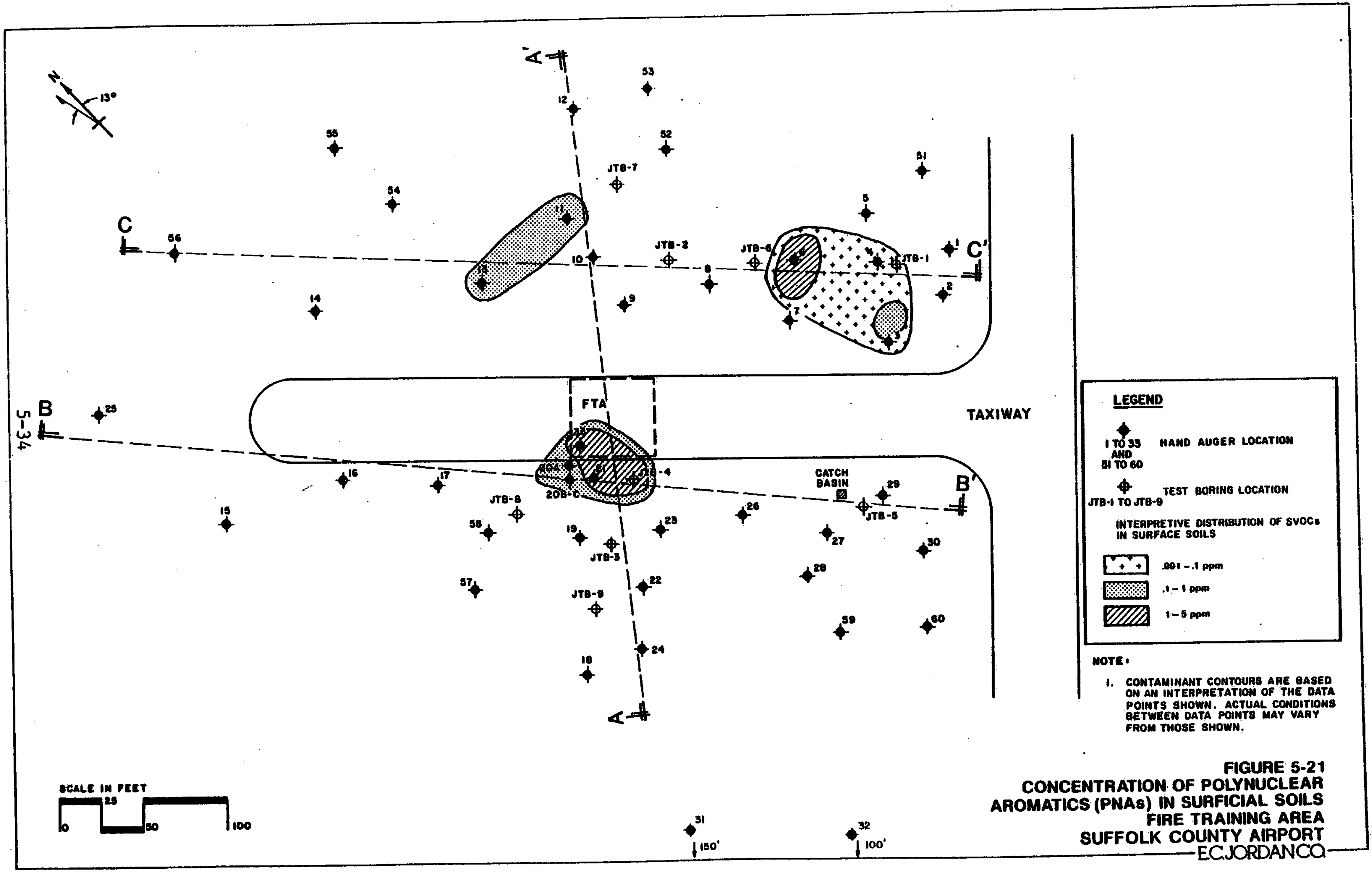

5-34

FIGURE 5-21
CONCENTRATION OF POLYNUCLEAR AROMATICS (PNAs) IN SURFICIAL SOILS
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

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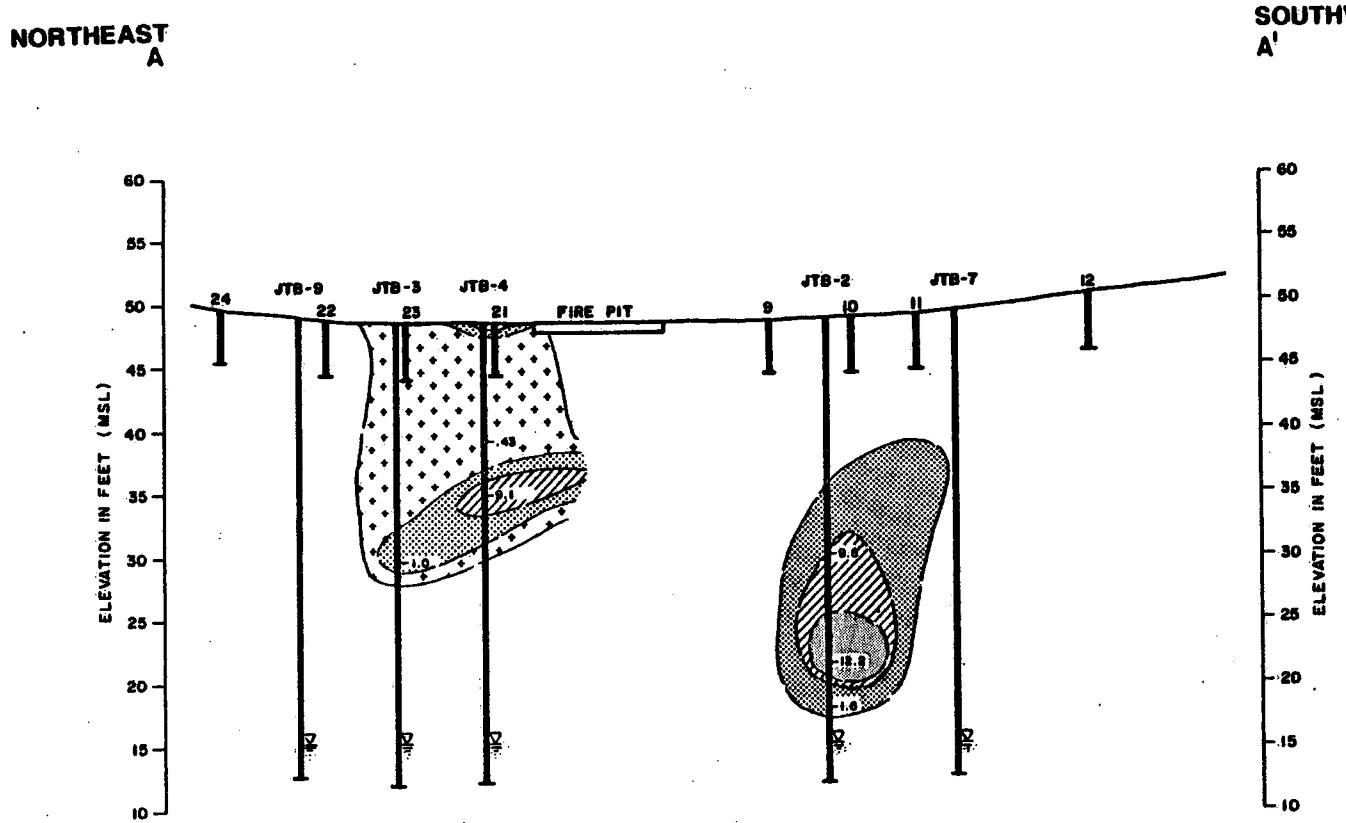

LEGEND

JTB-1	JORDAN TEST BORING
23	SOIL SAMPLE NUMBER
	DEPTH TO GROUNDWATER BASED ON SPLIT-SPOON OBSERVATIONS

INTERPRETIVE DISTRIBUTION OF SVOCs IN SUBSURFACE SOILS

- .1 – 1 ppm
- 1 – 5 ppm
- 5 - 10 ppm
- >10 ppm

NOTES:

1. SEE FIGURE 5-21 FOR HORIZONTAL LOCATION OF SOIL BORINGS AND TEST BORINGS
2. SEE FIGURE 5-21 FOR LOCATION AND ORIENTATION OF PROFILE A-A'.
3. CONTAMINANT CONCENTRATION CONTOURS ARE BASED ON DATA POINTS TAKEN AT 5-FOOT DEPTH INTERVALS. ACTUAL CONCENTRATIONS AT DEPTH MAY VARY FROM THOSE SHOWN.

SCALE IN FEET
0 25 50 100
VERTICAL EXAGGERATION 5:1

FIGURE 5-22
VERTICAL DISTRIBUTION OF PNAs IN SOILS AT PROFILE A-A'
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

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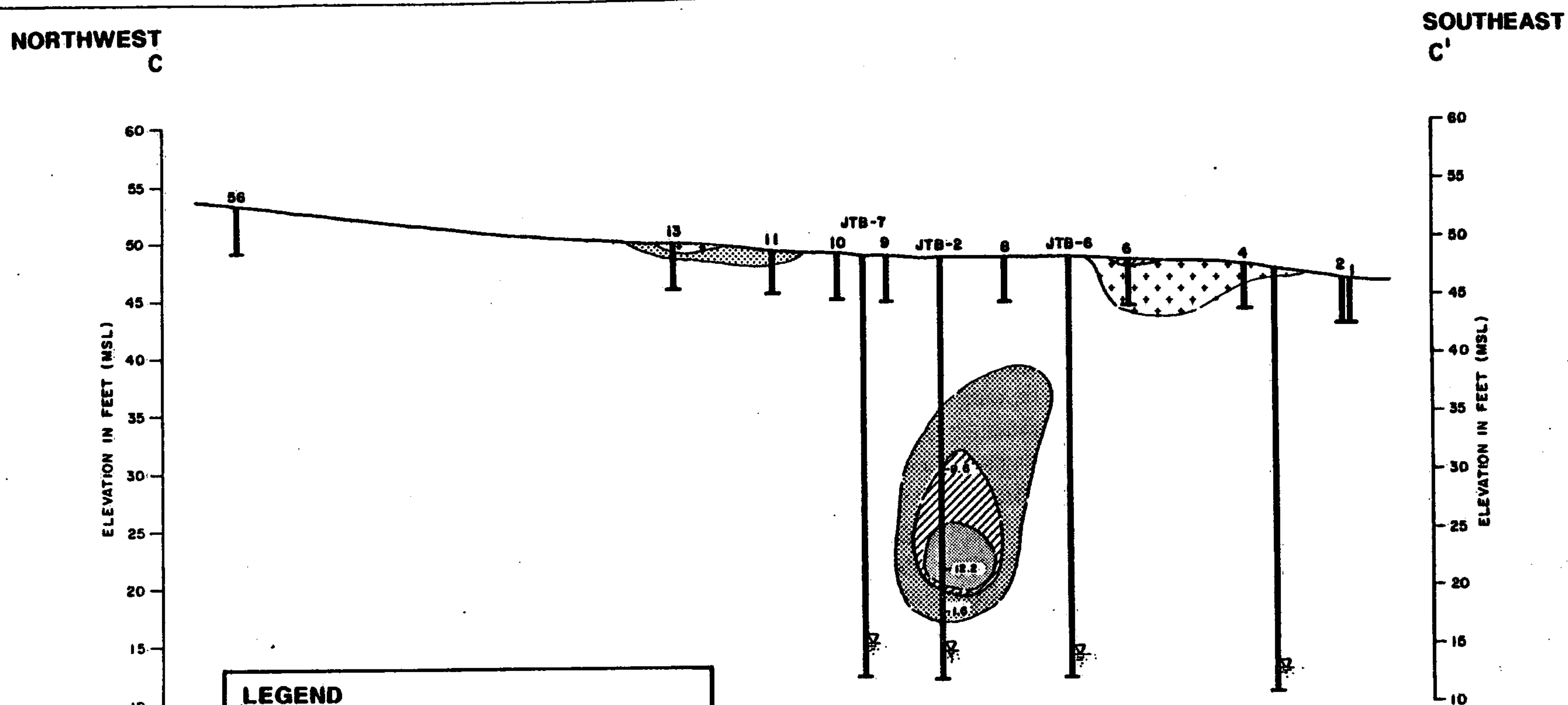

LEGEND

JTB-1	JORDAN TEST BORING
23	SOIL SAMPLE NUMBER
∇	DEPTH TO GROUNDWATER BASED ON SPLIT-SPOON OBSERVATIONS

INTERPRETIVE DISTRIBUTION OF SVOCs IN SUBSURFACE SOILS

- .1 – 1 ppm
- 1 – 5 ppm
- 5 – 10 ppm
- >10 ppm

NOTES:

1. SEE FIGURE 5-21 FOR HORIZONTAL LOCATION OF SOIL BORINGS AND TEST BORINGS.
2. SEE FIGURE 5-21 FOR LOCATION AND ORIENTATION OF PROFILE C-C'.
3. CONTAMINANT CONCENTRATION CONTOURS ARE BASED ON DATA POINTS TAKEN AT 5-FOOT DEPTH INTERVALS. ACTUAL CONCENTRATIONS AT DEPTH MAY VARY FROM THOSE SHOWN.

SCALE IN FEET

0 25 50 100

VERTICAL EXAGGERATION 5:1

FIGURE 5-23
VERTICAL DISTRIBUTION OF PNAs IN SOILS AT PROFILE C-C'
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

E.C.JORDAN CO.

5096-06

6.0 GROUNDWATER

The interpretation of groundwater conditions is based on monitoring wells installed at the site and existing hydrogeologic reports for the area near the FTA site. Discussions of the exploration program, hydrogeologic conditions, sampling, and analytical results are presented in this section.

6.1 MONITORING WELLS AND PIEZOMETERS

Monitoring wells and piezometers were typically installed using 4.25-inch ID, hollow-stem augers. MW-107A was installed by the wash-and-drive method using a 6-inch ID steel casing. At specified intervals, standard penetration tests were conducted using a 2-inch OD, split-spoon sampler, driven into undisturbed soils ahead of the auger or casing. Figure 5-4 shows monitoring well and piezometer locations.

The wells and piezometers were generally constructed using National Sanitation Foundation Approved, Schedule 80 poly-vinyl chloride (PVC), 2-inch ID casing with flush-threaded joints. Well screens in MW-101A and MW-107A are of wrapped stainless steel construction, while the screen in P-4 is Schedule 40 PVC material. All other well screens are Schedule 80 PVC with 0.010-inch slot sizes. Figure 6-1 shows a typical well construction, and Table 5-1 summarizes the drilling program at the site.

All well screens were backfilled with clean silica sand above the screened interval. The augers or steel casings were raised so that only the clean silica sand would occupy the annular space around the well screen. Above the sand pack, all wells except the deep wells (MW-101A and MW-107A) had at least a 2-foot-thick bentonite pellet seal. In the two deep wells, a thick, natural-cave backfill was used rather than bentonite pellets. The pellets would have expanded before settling, resulting in bridging and a poor seal. In all cases, the annulus above the seal was backfilled with a cement/bentonite slurry. A cement plug and locking steel casing (flush-mount or stick-up) was installed for all wells at the ground surface. Appendix F contains monitoring well information details.

6.2 PERMEABILITY TESTING

On June 17, 18, and 19, 1987, Jordan personnel conducted rising-head permeability tests in five selected monitoring wells and piezometers to determine the hydraulic conductivity of the sand aquifer. An In-situ Hermit Data Logger with a 10-pounds-per-square-inch (psi) pressure transducer was used to record the time and head data during the test. Since the site soils are very permeable, the logger's logarithmic mode time schedule was used to determine the frequency at which the transducer output was read. This schedule provides data points every 0.2 seconds during the first two seconds of each test, a necessary condition since the rise to static water level took only a few seconds for each test.

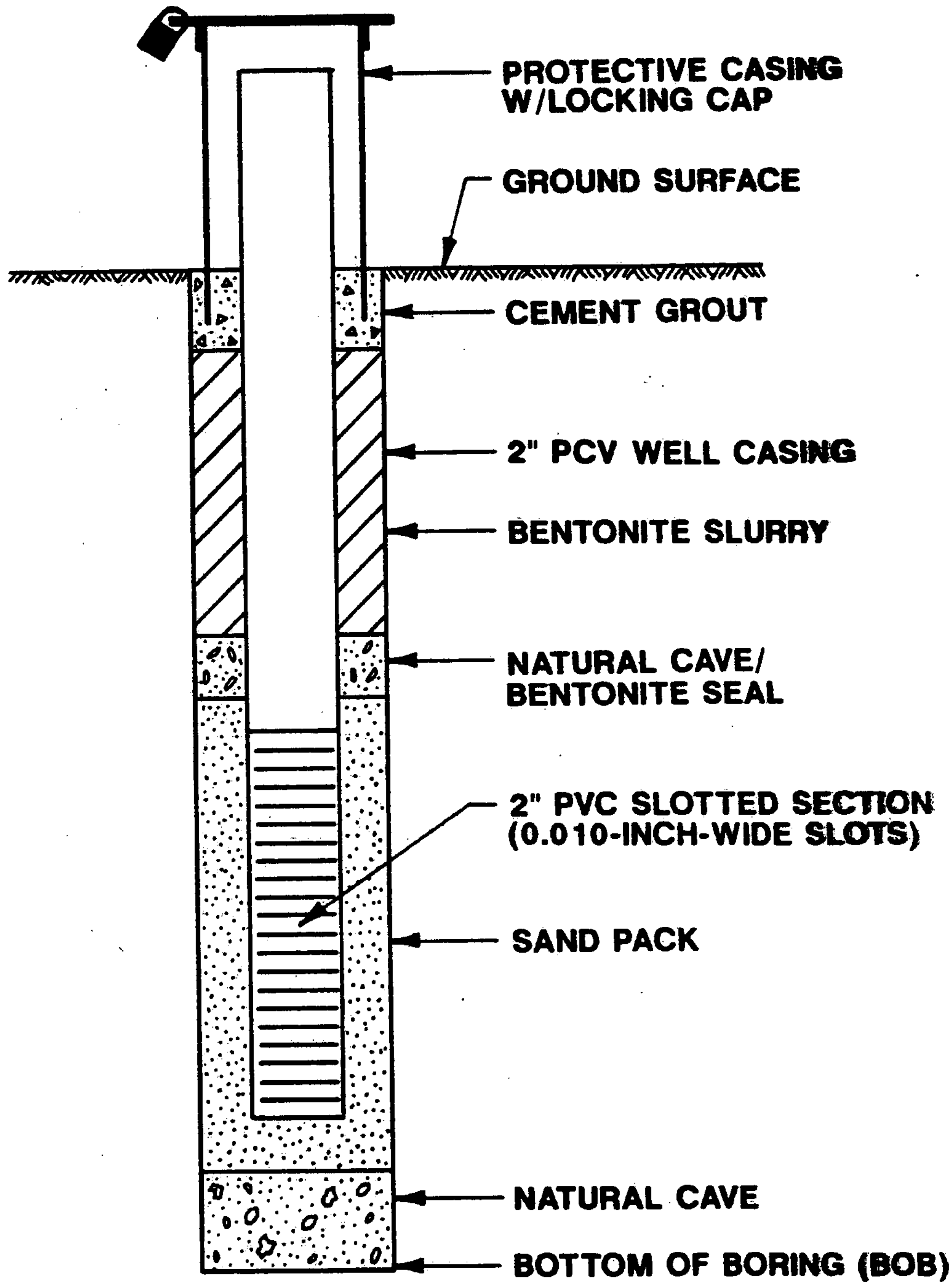

FIGURE 6-1
TYPICAL MONITORING WELL INSTALLATION DETAIL
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

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As shown in Figure 6-2, a special fitting attached to the well permitted the water level in the well/piezometer to be depressed with compressed air. Theoretically, a pressure of 1 psi is capable of depressing the water column in the well by 2.3 feet. An electronic water level meter sensor was lowered to a predetermined level in the well to allow determination of the water level prior to initiating the test. Since the system is closed, the pressure transducer measures the total system pressure (including air pressure); therefore, the water level cannot be determined until the air pressure is released. To initiate the test recovery, the air line valve is closed. Then, almost simultaneously, the pressure release valve is opened and the data logger is started. The pneumatic pressure is released through the 2-inch valve, and air pressure in the well returns to atmospheric in less than 1 second. The transducer then begins to track the rise in water level in the well while the logger records the levels at the predetermined logarithmic time schedule.

Tests were only conducted in wells and piezometers with well screens entirely below the water table. Otherwise, air could have been lost to the formation through the screen. If falling-head tests had been employed, water flow could have been through the unsaturated zone, thus invalidating the test for determination of the hydraulic conductivity of the saturated zone. Tests were run in MW-101A, MW-107A, and MW-107B, and in piezometers P-3 and P-4. Water levels were depressed about 10 feet in all wells and piezometers except P-4, which was depressed only about 5 feet. These displacements were selected to avoid lowering the water levels below the top of the well screen intervals.

Figure 6-3 shows a plot of the head-versus-time data obtained from a typical test. The formation is so permeable that inertial effects (i.e., the mass and velocity of the rising water column) are appreciable and damped oscillations of the head occur with time. Table 6-1 summarizes the values of hydraulic conductivity calculated from test data. The average hydraulic conductivity value for wells both in the vicinity of and downgradient from the FTA was about 99 ft/day cm/sec, with a range of 57 to 184 ft/day. Results for the wells/piezometers were consistent both individually and as a group. A maximum value of about 0.162 cm/sec was obtained in P-4 (west of the FTA). Details of the data and calculations from all hydraulic conductivity tests are presented in Appendix G.

6.3 WATER LEVEL OBSERVATIONS

Groundwater levels were periodically measured in the monitoring wells and piezometers during the course of the exploration program. This information was obtained to construct a groundwater surface contour map, from which hydraulic gradients and flow directions beneath the site were interpreted (see Section 6.4). Complete sets of water level measurements for all monitoring wells and piezometers installed at the site were taken on seven separate occasions (i.e., April 28, 29, and 30; May 1; June 17 and 19; and July 7, 1987). Water levels in individual monitoring wells fluctuated from 0.33 to 1.04 feet during this period. Water levels obtained on June 19, 1986, were used to generate hydrogeologic information at the site. Water level data are tabulated in Appendix H.

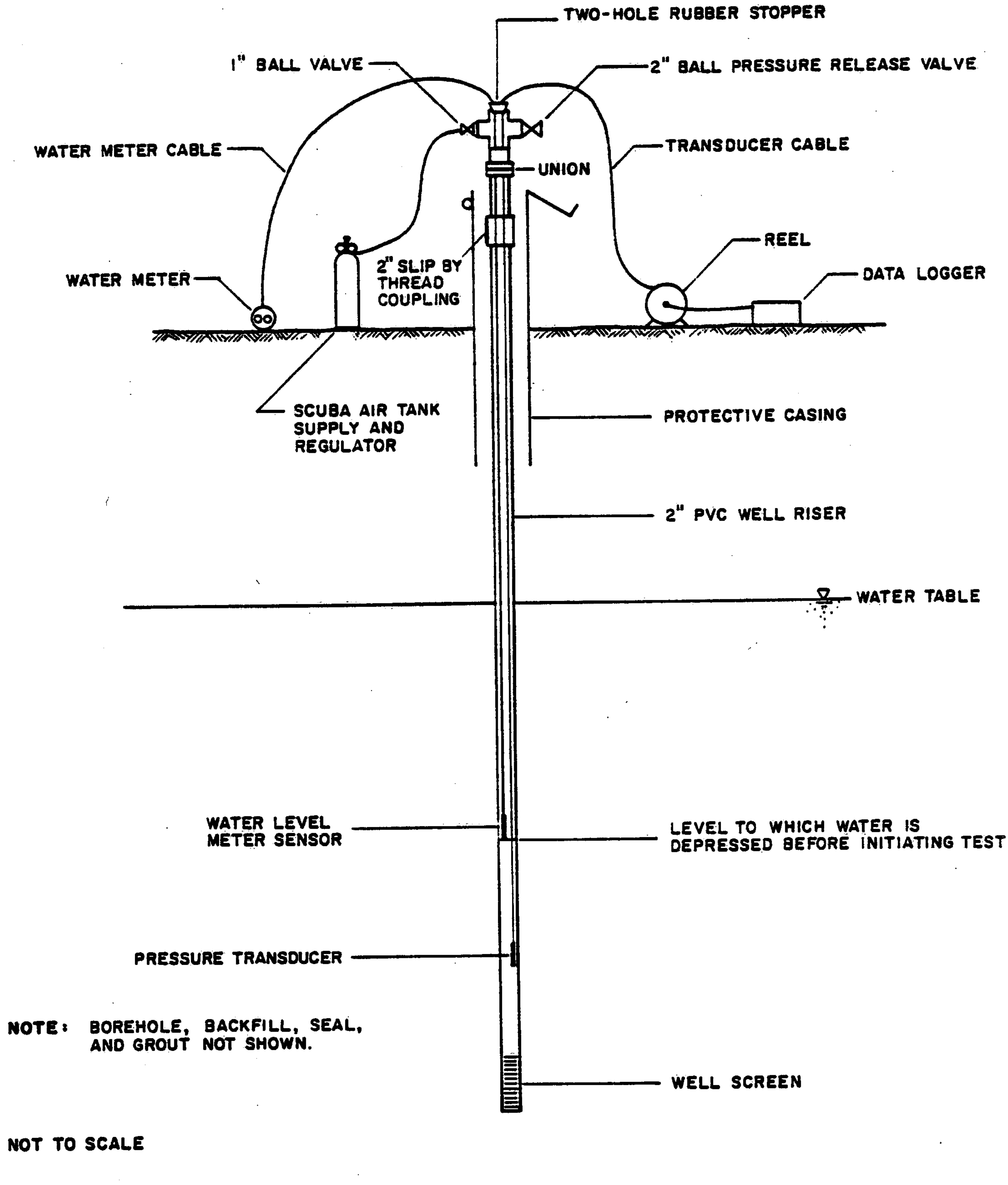

FIGURE 6-2
PERMEABILITY TEST APPARATUS
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

E.C.JORDAN CO.

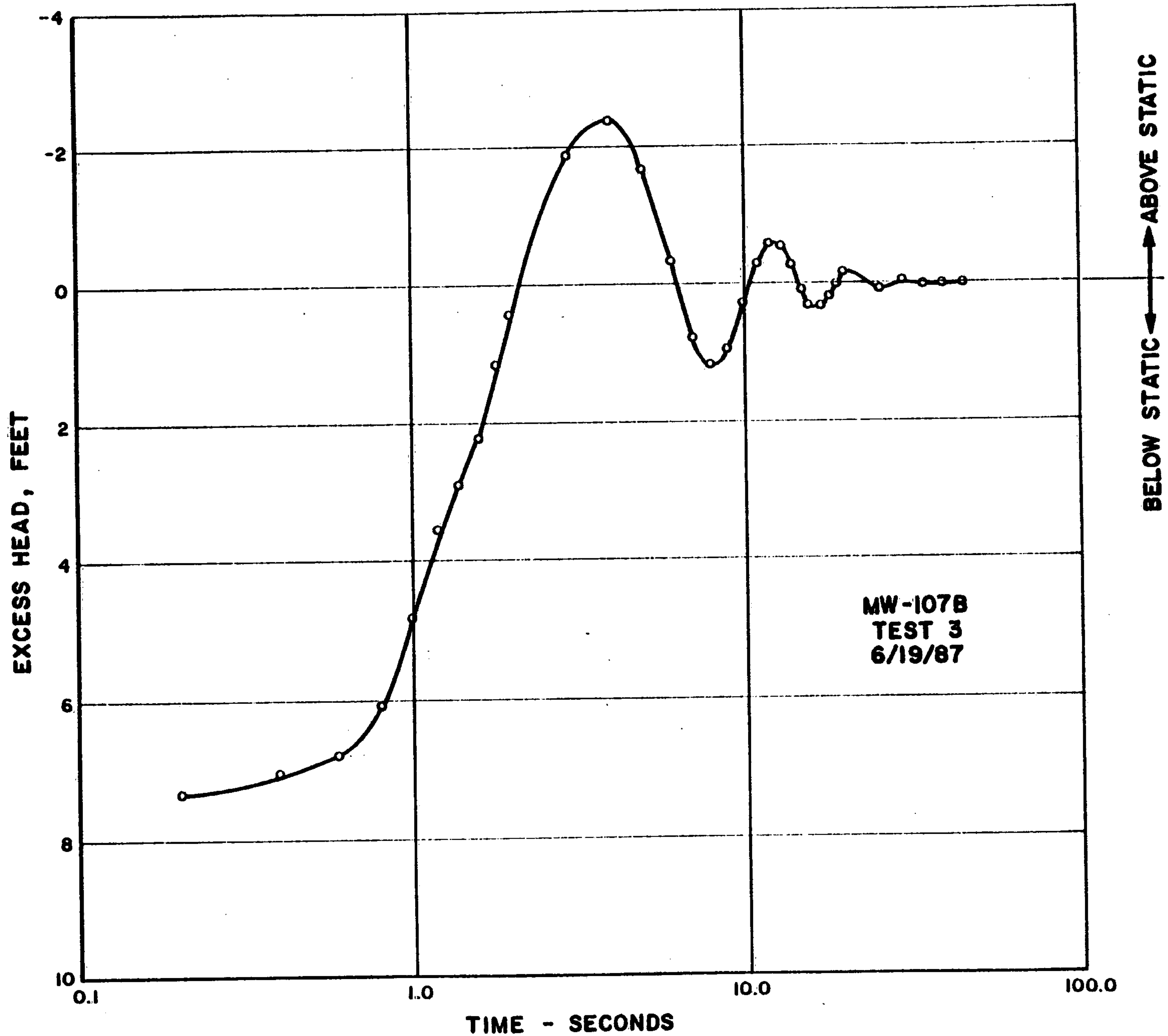

FIGURE 6-3
TYPICAL PERMEABILITY TEST OUTPUT
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

E.C.JORDAN CO.

5096-06

TABLE 6-1

SUMMARY OF HYDRAULIC CONDUCTIVITY TESTS
SUFFOLK COUNTY AIRPORT FIRE TRAINING AREA

Well	Test 1	Test 2	Test 3	Test 4	Average
MW-101A	.023	.020	*	*	.021 cm/sec
MW-107A	.031	.024	*	*	.028 cm/sec
MW-107B	.041	.032	.038	.065	.044 cm/sec
P-3	.041	.048	.042	.048	.045 cm/sec
P-4	.162	.140	.151	.152	.151 cm/sec

* No test performed

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0001.0.0

6.4 HYDROGEOLOGY

6.4.1 Regional Hydrogeology

The Suffolk County Airport is underlain by three aquifers and two aquitards (see Figure 5-2). Directly overlying the metamorphic bedrock is the confined Lloyd Aquifer, which is a sand and gravel aquifer approximately 400 feet thick. The Magothy Aquifer is located above this unit and is separated from the Lloyd Aquifer by the Raritan Clay Member. The Magothy Aquifer is confined and consists of sand and clayey sand deposits approximately 930 feet thick. Below the airport, the top of the Magothy Aquifer is approximately 150 feet below mean sea level (MSL). The potentiometric surface of this aquifer is reported to be approximately 15 feet above MSL.

The upper sand and gravel aquifer is located directly beneath the Suffolk County Airport and is separated from the Magothy Aquifer by the Gardiners Clay, which is reportedly 40 to 76 feet thick. The upper glacial aquifer is unconfined and consists of very porous and highly permeable coarse sands and gravels. There is virtually no surface runoff. This aquifer is generally 120 feet thick and flows southeast toward the headwater area of Quantuck Creek. Regional groundwater flow is shown in Figure 6-4. Deep regional groundwater flows to the north, ultimately discharging into Long Island Sound (Dames and Moore, 1986).

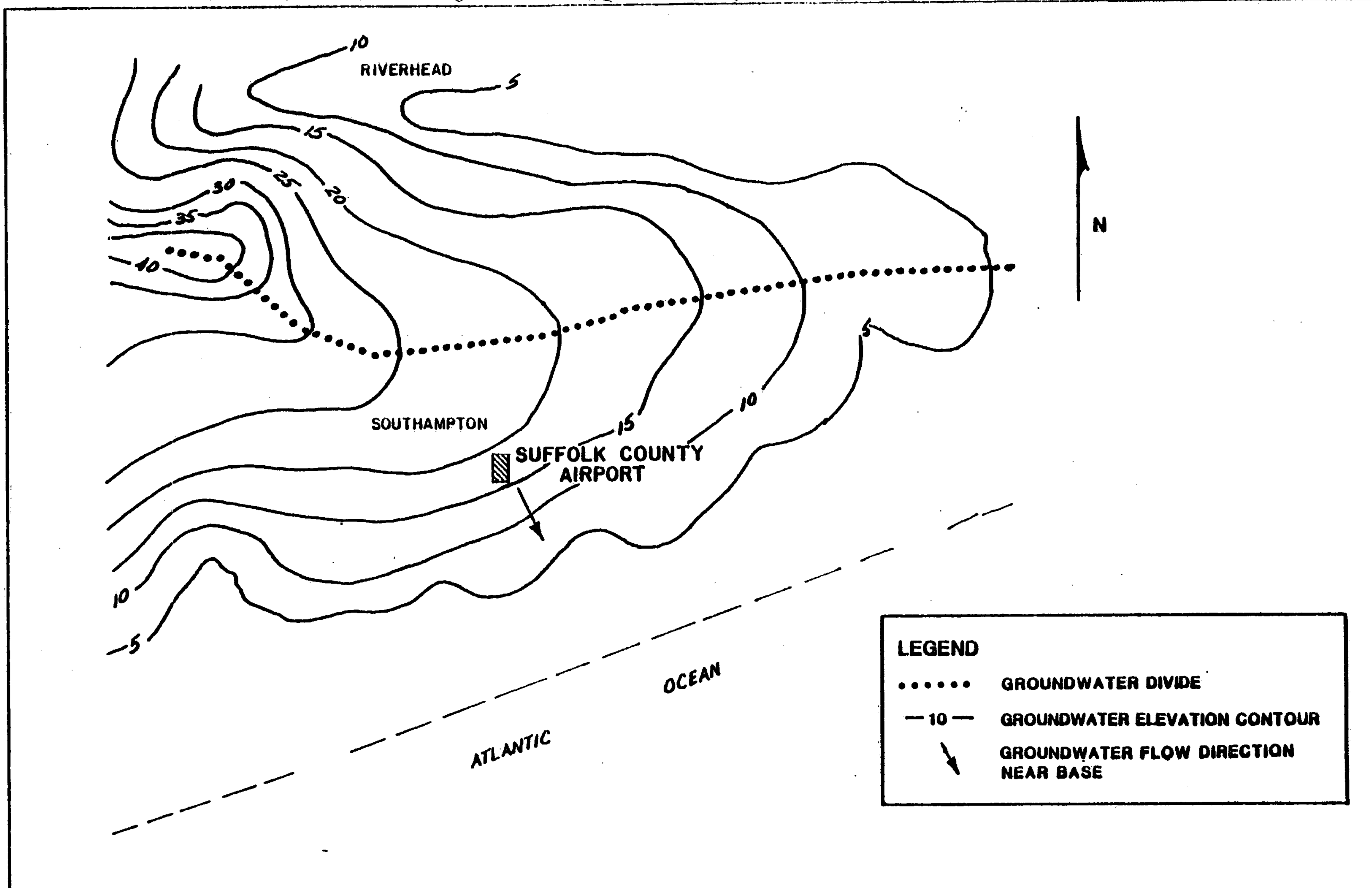
6.4.2 Local Hydrogeology

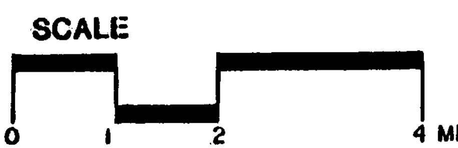
Groundwater at the FTA site occurs within the upper sand and gravel glacial aquifer and is unconfined. Groundwater in the site vicinity flows southeast toward Quantuck Creek. Flow patterns are generally uniform in direction and rate of flow. An interpretive groundwater surface contour map is shown in Figure 6-5.

Groundwater flows within the upper sand and gravel aquifer. The aquifer consists predominantly of medium to fine sands with trace silts. The soils did not appear to change significantly with depth, and exceeded a thickness of 150 feet in the southeastern portion of the site. The FTA site and surrounding area serves as a groundwater recharge area. A very slight downward hydraulic gradient of .001 ft/ft exists in the vicinity of MW-107A and MW-107B. Vertical gradients measured in the vicinity of MW-101A and MW-101B were very small, but generally upward for the data sets available. Horizontal groundwater gradients are generally uniform across the FTA site, averaging .0023 ft/ft.

Hydraulic conductivity values across the site range from 57 to 184 ft/day. The average hydraulic conductivity value for the FTA site is 3.5×10^{-2} cm/sec, or approximately 99 ft/day. Assuming a representative effective porosity of 0.30 for the soils at the site and a gradient of 0.0023, the average groundwater velocity for the site is approximately 300 ft/yr.

In general, the site is in a recharge area above a shallow groundwater system which ultimately discharges, under unconfined conditions, in Quantuck Creek southeast of the site (approximately one mile).





BASED ON A FIGURE FROM THE USGS REPORT "HYDROLOGIC APPRAISAL OF THE PINE BARRENS, SUFFOLK COUNTY, NEW YORK" (1986)

FIGURE 6-4
REGIONAL GROUNDWATER TABLE ELEVATIONS
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

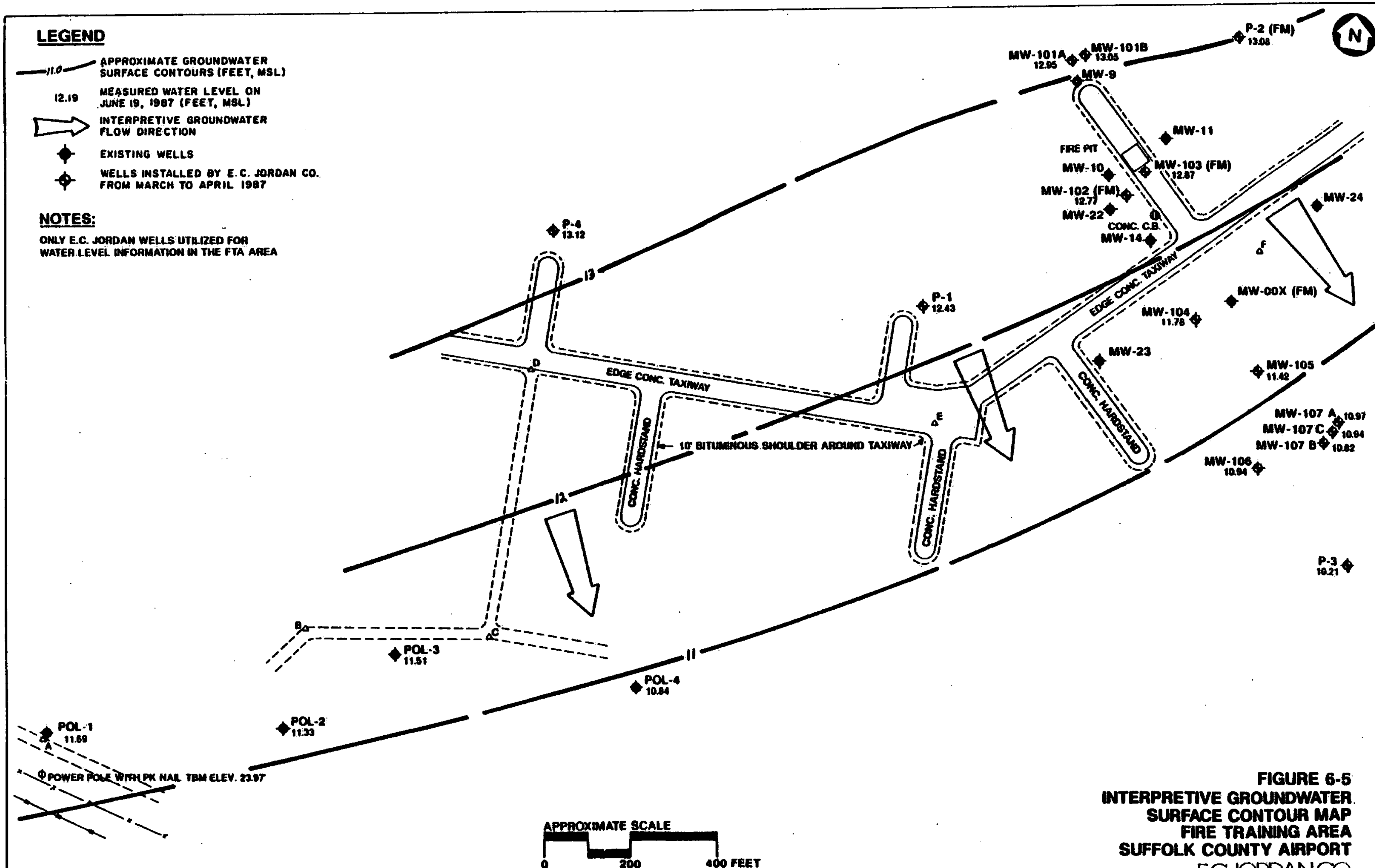


FIGURE 6-5
INTERPRETIVE GROUNDWATER SURFACE CONTOUR MAP
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT
E.C.JORDAN CO.

5096-08

6.5 GROUNDWATER USE CLASSIFICATION

Groundwater is the only water supply source for Suffolk County. The majority of water in the Suffolk County Airport area is obtained from the upper sand and gravel aquifer. Groundwater is obtained, to a lesser extent, from the Magothy and Lloyd aquifers. Currently, the Suffolk County Water Authority supplies the majority of potable water for the area. The central Suffolk County area contains 31 public supply wells. The Suffolk County Water Authority operates 15 wells in six well fields in this area (Dames and Moore, 1986). In 1982, the average public water supply withdrawal in the central Suffolk County area was estimated at 9.09 million gallons/day (mgd), with 7.9, 1.0, and 0.2 mgd withdrawn from the upper glacial aquifer, the Magothy Aquifer, and the Lloyd Aquifer, respectively. A municipal wellfield located approximately 3/4 mile southeast is the nearest public water supply to the FTA site (Figure 6-6). A search of the town records and an inspection of the area within one mile downgradient of the FTA did not reveal any water supply wells other than the municipal wellfield.

Groundwater is also used for irrigation. Pumpage for farm and golf course irrigation is estimated at less than 0.5 mgd, drawn solely from the upper glacial aquifer (Krulikas, 1986).

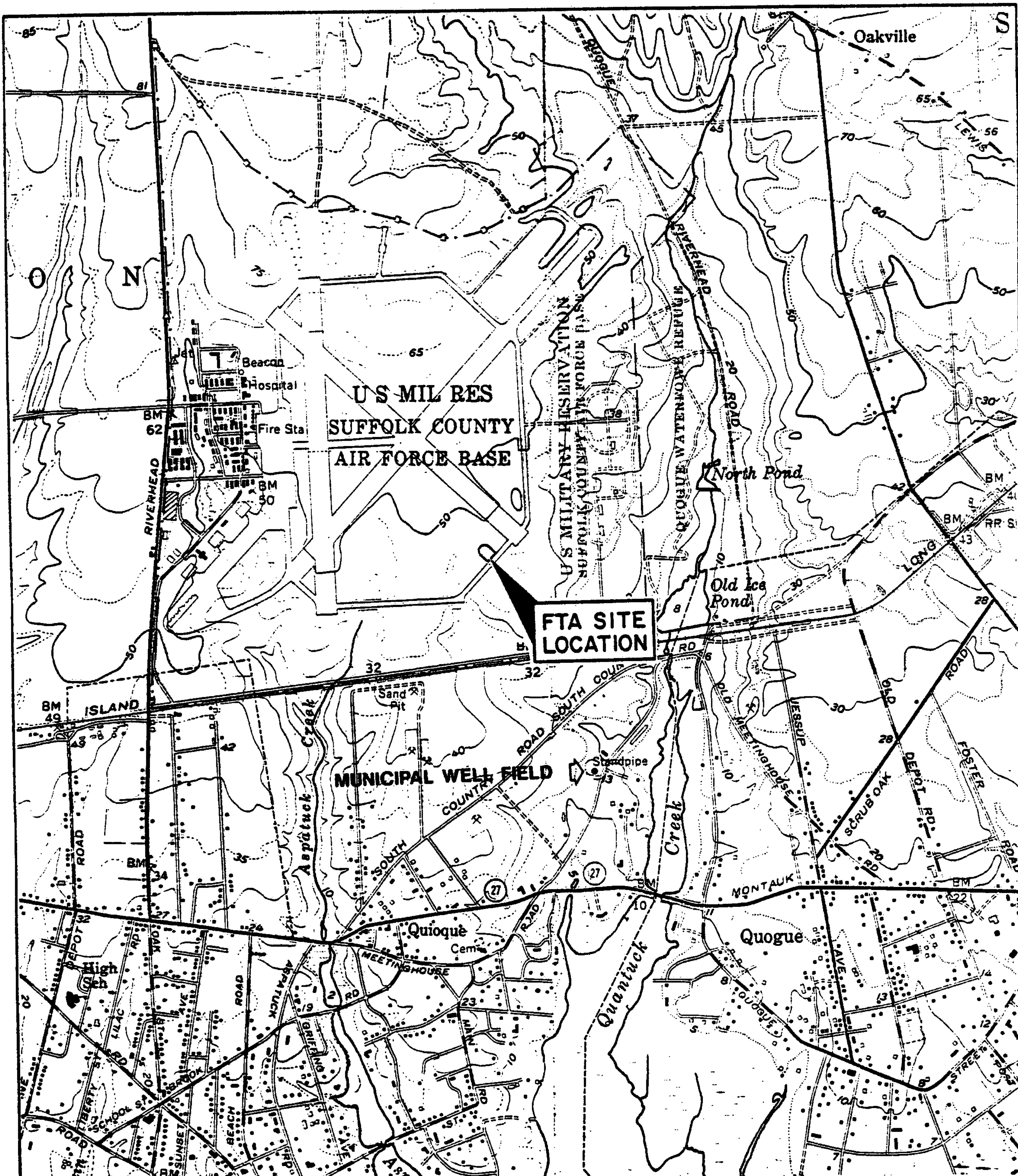
The upper glacial aquifer is the most readily available groundwater source. However, wells could be drilled into the underlying Magothy Aquifer if the upper aquifer proved inadequate. Withdrawal from the Lloyd Aquifer is restricted by New York State legislation to the south shore barrier islands and other areas with specific supply problems.

6.6 GROUNDWATER SAMPLING

Groundwater sampling consisted of two separate rounds of sampling. On June 1 through 4, 1987, MW-101 through MW-107 were sampled. From July 14 through 16, 1987, these wells, plus P-3, were resampled as part of the second round of groundwater sampling. All monitoring wells were sampled according to provisions in the QAPP. The location of monitoring wells sampled during the RI are show in Figure 6-7. Groundwater samples were shipped to CompuChem Laboratories according to EPA's CLP procedures. Analytical results are tabulated in Appendix I; the following section discusses the interpretation of these results.

6.7 RESULTS OF ANALYSES

Groundwater samples from all new FTA site wells were analyzed for petroleum hydrocarbons, VOCs, SVOCs, and lead. Lead was not found above the detection limit (10 ppb) in any monitoring wells at the site (MW-101 to MW-107 and P-3). The results of Round 1 and Round 2 groundwater sample analyses are discussed in the following sections and presented in Table 6-2. Figure 5-4 shows all monitoring wells and piezometers installed at the site. Figure 6-7 illustrates the distribution of contamination in groundwater from monitoring wells at the FTA site. Figure 6-8 illustrates the distribution of contamination in groundwater along cross-section profile 'D-D'.



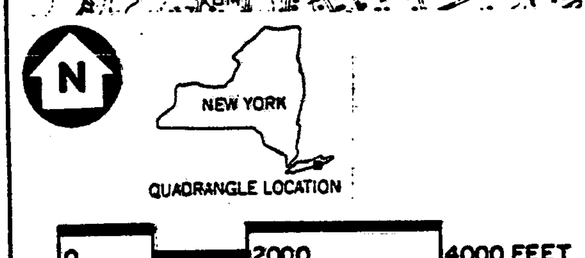


FIGURE 6-6
GROUNDWATER USE CLASSIFICATION MAP
FIRE TRAINING AREA SUFFOLK COUNTY AIRPORT

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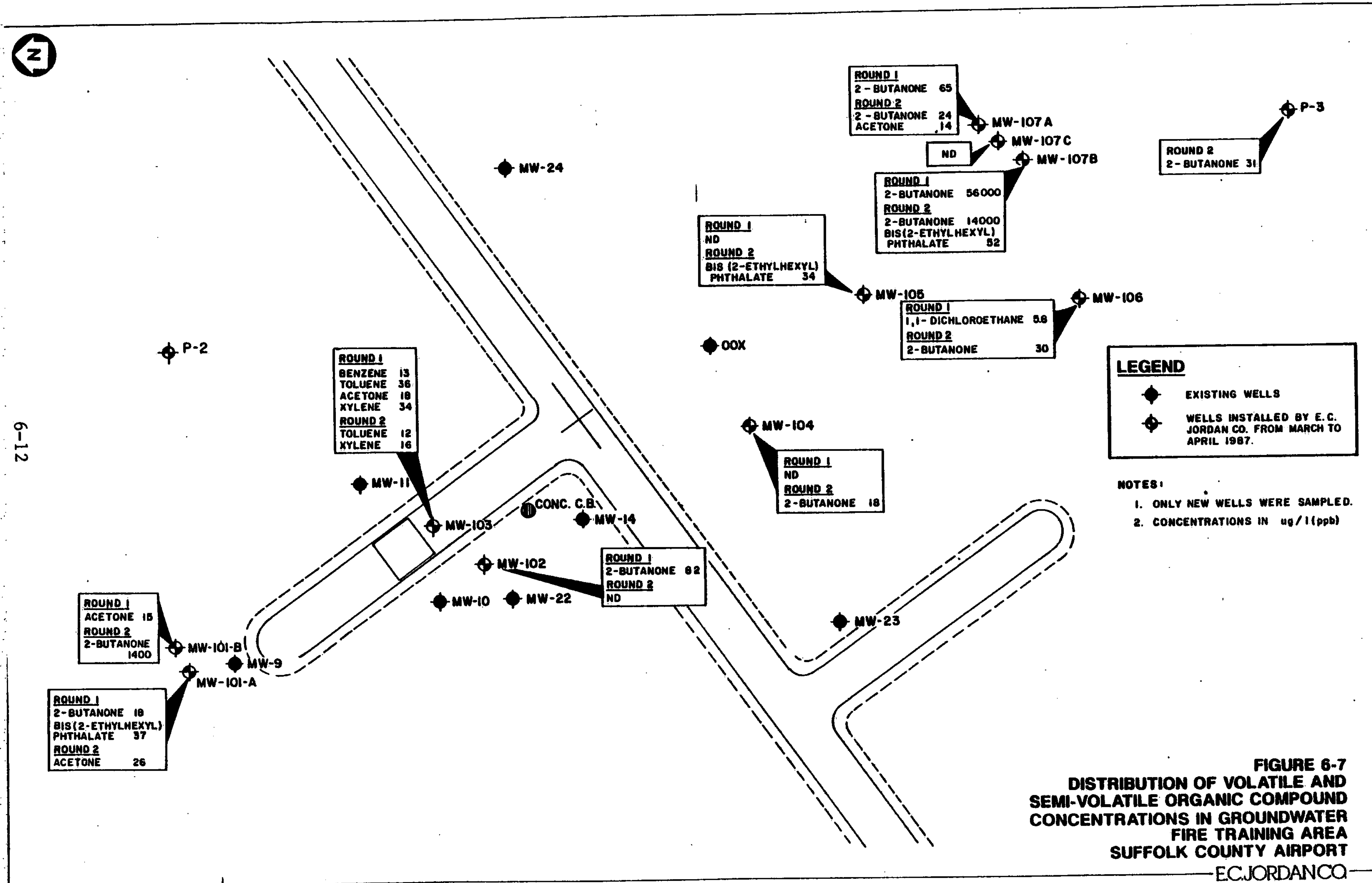


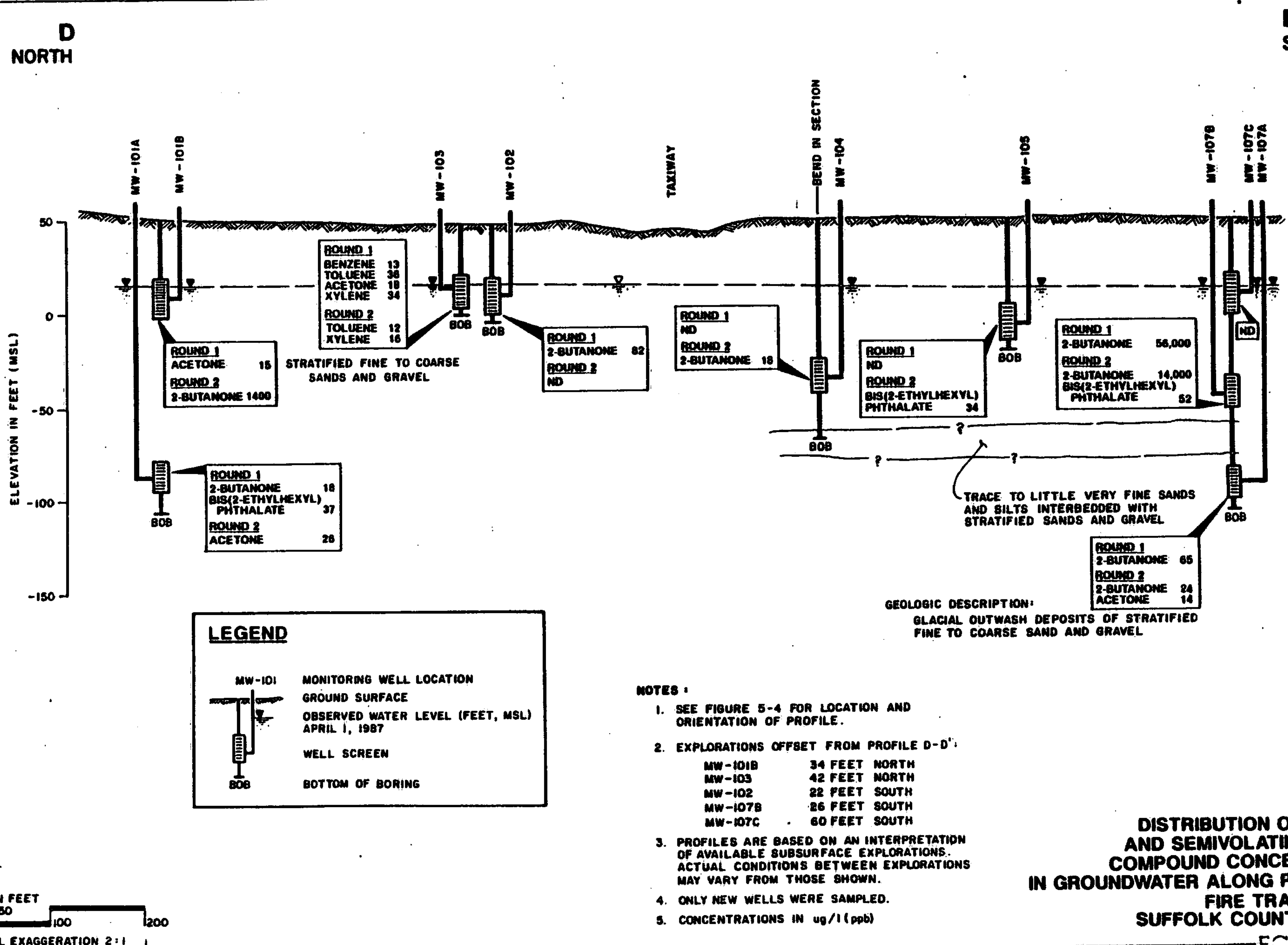
FIGURE 6-7
DISTRIBUTION OF VOLATILE AND SEMI-VOLATILE ORGANIC COMPOUND CONCENTRATIONS IN GROUNDWATER
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

TABLE 6-2

SUMMARY OF CONTAMINANT CONCENTRATIONS IN GROUNDWATER SAMPLES (ppb)
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

	Monitoring Well Locations										
	MW-101A	MW-101B	MW-102	MW-103	MW-104	MW-105	MW-106	MW-107A	MW-107B	MW-107C	P-3
Volatile Organic Compunds											
Acetone	-- 26*	15	--	18	--	--	--	-- 14*	--		
2-Butanone	18 (28 Dup)	-- 1,400*	82	--	-- 18*	--	-- 30*	65 24*	56,000 14,000*		31*
Benzene	--	--	--	13	--	--	--	--	--		
Toluene	--	--	--	36 12*	--	--	--	--	--		
Xylenes	--	--	--	34	--	--	--	--	--		
1,1-Dichloroethane	--	--	--	--		--	5.8 (5.8 Dup)	--	--		
Chloroform				16*							
Semivolatile Organic Compounds											
Bis(2-ethylhexyl)phthalate	37	--	--	--	--	-- 34*	--	--	-- 52*		

-- = Not Detected
* = Round 2 Sampling
Dup = duplicate analysis



NOTES:

1. SEE FIGURE 5-4 FOR LOCATION AND ORIENTATION OF PROFILE.
2. EXPLORATIONS OFFSET FROM PROFILE D-D':

MW-101B	34 FEET	NORTH
MW-103	42 FEET	NORTH
MW-102	22 FEET	SOUTH
MW-107B	26 FEET	SOUTH
MW-107C	60 FEET	SOUTH

3. PROFILES ARE BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE EXPLORATIONS. ACTUAL CONDITIONS BETWEEN EXPLORATIONS MAY VARY FROM THOSE SHOWN.
4. ONLY NEW WELLS WERE SAMPLED.
5. CONCENTRATIONS IN ug/l (ppb)

FIGURE 6-8
DISTRIBUTION OF VOLATILE AND SEMIVOLATILE ORGANIC COMPOUND CONCENTRATIONS IN GROUNDWATER ALONG PROFILE D-D'
FIRE TRAINING AREA
SUFFOLK COUNTY AIRPORT

E.C.JORDAN CO.

5096-06

6.7.1 VOCs

VOCs were detected in seven monitoring wells in the first round of sample analyses (i.e., MW-101A, MW-101B, MW-102, MW-103, MW-106, MW-107A, and MW-107B). Total VOC concentrations in Round 1 groundwater samples generally ranged from 5.8 to 101 ppb, with the exception of 2-butanone in MW-107B (56,000 ppb). Total VOC concentrations in Round 2 groundwater samples generally ranged from 26 to 52 ppb with the exception of 2-butanone in MW-107B (14,000 ppb) and MW-101B (1,400 ppb).

6.7.2 SVOCs

SVOCs were only detected in MW-101A in the first round of sampling: bis-(2-ethylhexyl)phthalate at 37 ppb. SVOCs were detected in MW-105 and MW-107B in the second round of sampling: bis(2-ethylhexyl)phthalate at 34 and 52 ppb, respectively.

7.0 SURFACE WATER

7.1 LOCAL AND REGIONAL WATERSHEDS

Surface water runoff in the Suffolk County Airport area flows in a southern and southeastern direction. Runoff from the airport mainly percolates into the soil and moves in the subsurface aquifers, although some sheet flow may occur in the site vicinity during the winter and spring runoff events.

The western portion of the airport drains to Aspatuck Creek, while the eastern portion flows to Quantuck Creek. Both creeks flow into Quantuck Bay, which is separated from the Atlantic Ocean by a narrow barrier island. Quantuck Creek is dammed just north of the Long Island Railroad tracks, separating the system into southern tidal and northern non-tidal portions. The dam itself forms Old Ice Pond. Further upstream on Quantuck Creek, another dam forms North Pond.

The only surface water feature on the base is the headwater of Aspatuck Creek. The FTA site is located within the Quantuck Creek drainage basin. Flow from the FTA site is ultimately toward the upper tidal portion of Quantuck Creek, which is approximately 0.75 miles southeast (Dames and Moore, 1986).

7.2 SURFACE WATER CLASSIFICATION

As discussed previously, Quantuck Creek is the nearest surface water body to the FTA site. Quantuck Creek has been assigned several use classifications by NYSDEC. From its mouth to Route 27, the creek is classified as a tidal salt water (SA) area, suitable for shellfishing, fishing, and bathing. At the present time, these waters do not meet the required quality standards for shellfishing and, therefore, are closed to this activity.

From Route 27 north to the Old Ice Pond dam, the creek is classified as a tidal salt water area (SC), suitable for fishing and fish propagation. The Old Ice Pond is suitable for fishing (Class C); however, bathing or drinking and food-processing water supply use are restricted.

Regulations prohibit fishing in Old Ice Pond, which is part of the Quogue Wildlife Refuge. Quantuck Creek, upstream of the pond, is a Class D drainage. The reach, included as part of the Quogue Wildlife Refuge, is used as a natural feature for wildlife management (Dames and Moore, 1986).

8.0 AIR

Reconnaissance of the site and the known use of the site did not indicate the likelihood of an air emissions problem from VOC contamination in soils. Therefore, a specific program of air sampling and analysis was not implemented. As shown in Figure 5-18, VOCs in surficial soils are restricted to a small area in the center of the FTA. Analyses of surficial and near-surficial soils, and the distribution of VOCs at the FTA, confirm the low potential for emissions of VOCs.

Air quality at the FTA site was monitored for VOC emissions with a Photovac TIP ionization meter during subsurface explorations. Ambient air, borehole headspace, and soil sample headspace were monitored, but no significant concentrations were detected above ambient air background levels.

9.0 ABOVE- AND BELOW-GROUND STRUCTURES

The FTA is situated on a 9 to 10-inch-thick concrete hardstand, which is 50 feet wide by approximately 400 feet long and extends at right angles from a similarly constructed taxiway. Both the taxiway and hardstand are bordered by a 10- to 11-foot-wide asphalt macadam apron.

In 1978, a concrete curbing defining the present burn pit was installed on the hardstand. The curbing stands about 1 foot high and forms a square about 50 feet on a side.

An aboveground, 15-foot-long fuel storage tank is located approximately 150 feet southwest of the FTA. Jet fuel (JP-4), used in fire-training exercises after 1971, is stored in this tank. The tank is connected to the pad via a fuel line which runs along the ground surface. Figure 9-1 shows the location of above- and below-ground structures at the FTA site.

A below ground tank was built to collect excess fuel after each fire-training exercise was performed. However, this tank was never used. At the time of the field work, this tank was about half filled with clear water. A burned-out trailer, previously used for fire training activities, and a free-standing, wooden shed are located at the north end of the taxiway. Some junk cars are also located at the FTA for rescue training purposes.

A sample of the water in the subsurface tank was taken on July 16, 1987, and analyzed for lead and total petroleum hydrocarbons. No lead or petroleum hydrocarbons were detected in the tank sample.

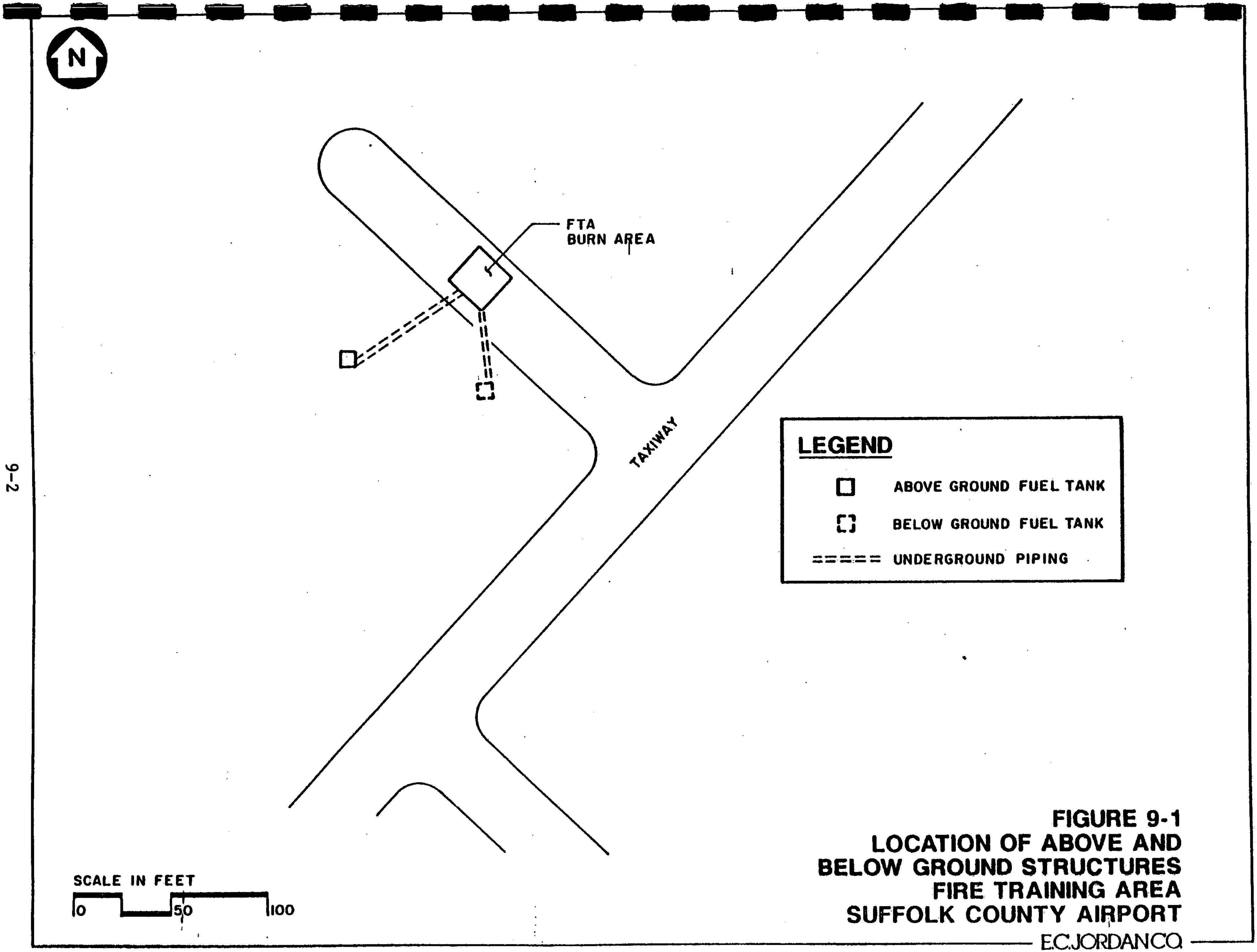


FIGURE 9-1
LOCATION OF ABOVE AND BELOW GROUND STRUCTURES FIRE TRAINING AREA SUFFOLK COUNTY AIRPORT

10.0 CONTAMINATION ASSESSMENT

This section presents an assessment based on contaminant distributions found in the various media at the FTA site and potential for contaminant migration. The principal contaminants found at the site were (1) PNAs, lead, VOCs, and oil and grease in soils; and (2) 2-butanone, xylene, toluene, and benzene in groundwater. The distribution of oil and grease contamination in soils, although not strictly a hazardous constituent, is useful in describing areas of apparent past use and transport mechanisms operative at the site. The key points of the assessment are summarized in Section 10.7. This assessment, together with specific data presented earlier, forms the basis for the baseline risk assessment presented in Section 11.0 of this RI report.

10.1 SOIL

Based on the residual contamination in soil, it is apparent that there had been three principal areas where fuels for fire-training exercises were placed on the ground or flowed off to the side of the hardstand. These areas are located immediately to the east of the present FTA burn containment area (near JTB-2), to the southwest (toward the taxiway), and to the west-northwest of the present burn area. Contaminants in the soil are deeper at these locations and likely reflect the action of fuel/solvents which carried the oil and grease, PNAs, and other organic contaminants downward. Away from these areas of concentrated application, wind action has distributed burn products or contaminated surface soils over a larger area. Contamination in this larger area is typically very superficial and at much lower concentrations than in the three apparent principal areas of use.

Pathways for migration of contaminants in soils include the following:

- leaching by infiltrating rainwater and snowmelt
- leaching by infiltrating fuels/solvents (past occurrence and future potential)
- wind erosion of contaminated surficial soil particles
- volatilization out of the soil column into the air
- human activity with surficial soils (present and future)
- human activity with deeper soils (future potential)
- animal activity with surficial soils

Of these pathways and mechanisms, leaching by infiltrating precipitation, wind erosion, and human activity with surficial soils offer the greatest potential for continued migration under current site conditions. Given the site conditions, contaminant characteristics, and limited access, this potential is considered to be very low.

10.1.1 Organic Compounds

The principal VOCs found in the soil were total xylenes. Concentrations of xylenes in surficial soils were very low, where found, due to the tendency for xylenes to volatilize readily into the atmosphere. In two locations (i.e., in deeper soils to the east and west of the present burn area), elevated levels of xylenes up to 2.8 ppm remain in conjunction with elevated levels of PNAs and oil and grease. Although xylene is relatively soluble in water (175 mg/ℓ at 20°C), the presence of PNAs and oil and grease in elevated concentrations tends to restrict intimate contact with percolating rainwater, thereby creating a preferential substrate for the VOCs to remain in the soils. This would retard their migration due to either solubilization or volatilization. Xylenes have appeared as a contaminant in groundwater analyses for this study only in MW-103 (at 34 ppb), immediately downgradient of the FTA (see Section 10.2.2).

PNAs appear as the major group of SVOCs present in site soils, with some lesser amounts of phthalates and phenol. The predominant PNAs are interpreted as residual evidence of the presence of crude fuels and occurrence of burning. PNAs tend to have a low solubility in water and their presence would be expected as surface contaminants, as they are in much of the FTA site area. Maximum concentrations of PNAs in the surficial soils were about 5.7 ppm. Solvents/fuels introduced to the ground, however, have caused the migration of PNAs to greater depths in the locations of greater use (as noted previously). In these lobes of contaminants in the unsaturated zone, concentrations of PNAs range up to 12.2 ppm. PNAs have not appeared as contaminants in ground water, which attests to their low water solubility and relatively low mobility in the soil. Potential for further migration is probably low without further introduction of significant volumes of solvents/fuels to the ground above the contaminated soils. Neither the phthalates nor the phenols appear to be widespread or concentrated enough to pose a significant threat to the groundwater. Maximum concentrations reported for phthalates and phenols in soils were 0.51 and 4.7 ppm, respectively.

The distribution of oil and grease in soils highlights the principal use areas of the site and indicates boundaries of migration due to wind action. There are high concentrations that appear in the deeper soils at JTB-2, JTB-3, and JTB-4; however, in most areas, the concentrations are high only in surficial soils, dropping rapidly with depth.

10.1.2 Lead

The distribution patterns for lead match well with the patterns of oil and grease and other fuel-related contaminants. The distribution of lead tends to be more shallow, however, than the other parameters of concern. Although the lead may have been present originally in an organic form, the burning process would likely result in the formation of inorganic lead compounds (e.g., lead oxide). The inorganic form would be less susceptible to further migration caused by additional fuels and would also exhibit a low solubility in water. Thus, a shallower distribution of lead in soils could be anticipated. Present migration potentials for lead are limited to solubilization by water and migration to the groundwater, and wind erosion of contaminated surficial soils. These mechanisms are not considered to be significant transport pathways.

10.2 GROUNDWATER

Analyses for groundwater indicated the presence of only a few VOCs and SVOCs. The data could not be contoured in a classical plume shape, but generally indicated the presence of only low levels of contaminants in groundwater if they were present at all. Only the presence of 2-butanone at 56,000 ppb in MW-107B in Round 1 and 14,000 ppb in Round 2, appeared to indicate significant downgradient groundwater contamination. The presence of 1,400 ppb of 2-butanone in MW-101B in Round 2 appears to indicate significant upgradient contamination as well. However, 2-butanone was not detected in MW-103 and only at relatively low concentrations in MW-102 at the FTA (82 ppb). The low levels of fuel-related contaminants in the groundwater immediately downgradient of the FTA burn area suggest that the residual contaminants in soils and present operating conditions were contributing only low concentrations of contaminants to the groundwater. The distribution of 2-butanone upgradient and downgradient of the FTA indicates that the contamination may be the result of activities unrelated to the FTA.

The pathway for contaminant migration through groundwater is largely controlled by the hydrogeologic setting. Concentrations of contaminants in the groundwater are determined by a number of factors, including the release rate of the contaminant at the source, the source location, the groundwater flow rate, mixing potentials in the aquifer, source and solute decay rates, and attenuative mechanisms (e.g., dispersion, dilution, and retardation through adsorption). At the FTA, groundwater flows quite uniformly toward the southeast.

The groundwater velocity, which carries the solubilized contaminants, is the other principal factor in the transport of contaminants. The groundwater velocity has been estimated to be approximately 300 feet per year. Based on the average velocity, the time to arrive at MW-107 from the FTA is about three years after the contamination reaches the groundwater. However, due to longitudinal dispersion, first effects would probably occur somewhat sooner and, also due to retardation effects in the unsaturated zone at the FTA source, last effects would be noted for a longer time. Given a conservative travel time of three years for 2-butanone to reach MW-107 from the FTA, and the reports that the ANG has burned only jet fuel (JP-4) since 1971, the 2-butanone source appears to be unrelated to ANG FTA activities. Conservative calculations (see Appendix K) were conducted to account for only dispersion and dilution in the aquifer. Table 10-1 shows the ratios of source concentrations to receptor concentrations (i.e., dilution factors) for various distances downgradient of the FTA and along the path of the plume centroid (the maximum concentration in the plume). The calculation is also conservative in that it assumes a constant source.

Based on the data available, contamination from the FTA is not believed capable of migrating from the FTA toward the petroleum and oil storage area to the southwest or to the residences beyond in that direction. However, the direction of groundwater flow is toward the ocean; groundwater passing beneath the FTA may also be partially influenced by the municipal well field (see Sections 6.4 and 6.5). Based on travel times, contamination from the FTA during the earlier and most uncontrolled years of operation (if inadequately attenuated) should have reached the wells by now. No indications of contaminants related

TABLE 10-1

DILUTION FACTORS IN THE AQUIFER
SUFFOLK COUNTY AIRPORT FIRE TRAINING AREA

Distance to Receptor	Range of Dilution Factors
500 feet	7.1 to 13.3
1,000 feet	8.0 to 31.8
1,500 feet	11.4 to 54.4
2,000 feet	14.8 to 80.4
4,000 feet	29 to 211

to the FTA have been reported in analyses of the water district's monitoring wells between the well field and the FTA or of the water supply itself. In addition to the attenuation of contaminants in the plume itself, the influx of clean water to the wells from other directions also provides an additional dilution factor of approximately 1,000.

10.2.1 Upgradient Wells

The presence of low concentrations of acetone (15 ppb), 2-butanone (18 ppb), and bis(2-ethylhexyl)phthalate (37 ppb) in MW-101A and MW-101B do not appear to be significant. Acetone was also detected at 26 ppb in the second sampling round in MW-101A. Only the presence of 2-butanone at 1,400 ppb in MW-101B indicates significant upgradient contamination. Given the groundwater flow direction at the site, it appears unlikely that this contamination is the result of burning activities at the FTA site.

10.2.2 Downgradient Wells

Contaminants were noted in MW-102 and MW-103, close to the FTA burn area, and MW-104, MW-105, MW-106, and MW-107, located approximately 300 to 600 feet south of the taxiway. 2-Butanone was also detected in P-3 nearly 900 feet south of the taxiway.

MW-102 contained 82 ppb of 2-butanone, which is significantly less than the concentration in the upgradient well.

MW-103 contained low levels of three aromatic volatile organics: benzene (13 ppb), toluene (36 ppb, Round 1; 12 ppb, Round 2), and xylenes (34 ppb., Round 1; 16 ppb, Round 2); and low levels of acetone (18 ppb). The presence of the aromatics is typical of fuel-related contamination. It should be noted, however, that only xylene was still present in elevated concentrations in the soils.

The low concentrations of 2-butanone in MW-104 (18 ppb) and bis(2-ethylhexyl)-phthalate in MW-105 (34 ppb) detected in the second sampling round do not appear to be significant.

MW-106 contained the only indications of a chlorinated solvent present in the groundwater. First round analyses indicated the presence of trace level of 1,1-dichloroethane at 5.8 ppb. This well contained 30 ppb of 2-butanone in the second sampling round.

MW-107A, a deep well screened at 134.9 to 151.0 feet, contained 65 ppb of 2-butanone. In the second round of sampling, 24 ppb of 2-butanone and 14 ppb of acetone were detected.

MW-107B, screened from 89.5 to 104 feet, yielded a first round sample that contained 56,000 ppb of 2-butanone and a second round sample that contained 14,000 ppb of 2-butanone. A second round sample taken from P-3 contained 31 ppb of 2-butanone.

The groundwater direction has been shown to be directly from the FTA toward MW-106 and MW-107. Dispersion (i.e., spreading of the groundwater plume through the sand) would occur laterally and vertically, and infiltration of clean rainwater above the plume would aid in the vertical movement and dilution. The occurrence of the 2-butanone does not agree with the known use and the hydrogeology of the site. Jet fuel is reported to be the only fuel used at the FTA since the ANG took over FTA use in 1971; no 2-butanone was reported to be used since that time. Also, soil sampling located 2-butanone in only 2 locations in the soils around the FTA. Both samples were below the detection limits of 0.01 ppm. It is important to note that MW-105, screened 46 to 66 feet, should be able to sample the upper part of a plume if it were present. Natural site conditions appear to have dissipated the contaminants noted in prior analyses conducted in 1982.

Finally, it is noted that some ANG personnel suspect possible unauthorized and improper disposal of wastes (including solvents) by unknown persons at the FTA. Although access is limited at the airport, the site is somewhat remote and access is possible, particularly for some on-site commercial establishments. The presence in MW-107A, MW-107B, and MW-101B of solely 2-butanone (methyl ethyl ketone), which is a common paint solvent/thinner and not a significant component of JP-4, indicates that the contamination may be due to unauthorized dumping upgradient of the FTA at some other location. Given the relatively high solubility of 2-butanone in water, the contamination is more likely a slug input rather than a source of long duration.

10.3 SURFACE WATER

As noted in the site setting, the area soils do not permit appreciable runoff, nor are there surface water streams or bodies in the immediate site vicinity which would transport contaminants via this means. Some runoff carrying contaminants may have occurred from and along the hardstand area, but volatilization of fuels and sedimentation of solids would have occurred on the hardstand or taxiway. Little significant transport would be anticipated via this route.

10.4 AIR

Air sampling at the site included monitoring background levels and borehole and soil sample headspaces with a Photovac TIP ionization meter for VOCs. Site history, past data, reconnaissance information, and observation indicate that air emissions are not likely to be a problem; this was confirmed by chemical analyses of soil samples. Sufficient concentrations or areas of volatile contaminants do not exist in surface and near-surface soils to cause significant emissions of VOCs. The air, through wind erosion, may be a transport mechanism for contaminated surface soils; this potential will be addressed in the risk assessment through modeling.

10.5 BIOTA

No biota samples were taken for this investigation. The immediate vicinity of the FTA, which is sparsely vegetated due to natural environmental conditions and the use of the area, does not offer a favorable habitat for biota. Some animals may experience incidental contact with surficial contamination during transit across the site. Deer and dog tracks were noted in the vicinity of the FTA on several occasions. See Section 3.3 (Natural Resources) for a more complete perspective on local animal habitat.

10.6 STRUCTURES

The only structure of concern in the FTA is an underground tank intended to contain overflow from the burn containment area. During the initial phases of the RI, inspection of the tank did not indicate the past presence of contaminants (e.g., there was no visible sheen on the water surface in the tank). A sample taken from the tank in July 1987 confirmed this observation.

10.7 SUMMARY

In summary, the following conditions exist at the FTA:

- Contaminants such as oil and grease, PNAs, and lead cover a wide area of the site due to transport of smoke and combustion products during burns and subsequent migration of contaminated soil particles by wind erosion.

- Contaminant concentrations in soil generally decrease rapidly with depth in most areas, except those identified as the principal areas for burning and/or runoff on either side of the hardstand.

- Contamination occurs deeper in the unsaturated soils as lobes containing xylenes, PNAs, and oil and grease. The mechanism for transport was probably the repeated application of fuels/solvents in the burn areas, which solubilized the organics.

- Lead did not migrate relatively as deeply as the organics.

- Only low levels of contaminants were noted in groundwater from most wells, even in the immediate vicinity of the FTA. The exceptions are elevated concentrations of 2-butanone in MW-107B (56,000 ppb in Round 1; 14,000 ppb in Round 2), and 1,400 ppb in Round 2 at MW-101B.

- Residual contamination in soils at the FTA appears to be relatively immobile and not impacting groundwater significantly.

- Potential exists for transport through groundwater. However, there appears to be little or no impact of the FTA soils on groundwater. Significant dilution and dispersion factors exist in the aquifer which would significantly lower concentrations at potential downgradient receptor locations.

- Despite the fact that the airport has limited access, it is still possible that areas upgradient of the FTA received in the past, or still may continue to receive, unauthorized waste disposal.

11.0 BASELINE RISK ASSESSMENT

11.1 INTRODUCTION

The purpose of this baseline risk assessment is to evaluate the risks to public health and the environment posed by contaminants detected in the FTA. Estimates of risk are based on contaminant concentrations characterized through the RI. A baseline risk assessment is based on present conditions in absence of remedial action. The output of this baseline risk assessment is used to identify response objectives for the remedial actions and target clean-up levels, as appropriate.

Although groundwater data are available, the data are not considered to be sufficient to provide the necessary information to characterize exposure. This is because of the varying levels of contamination in downgradient wells. More data are required to determine accurately risks posed by this media. Groundwater is briefly addressed through a discussion of the transport and fate of the chosen contaminant of concern and its toxicological effects are summarized. The scope of this baseline risk assessment is essentially limited to an evaluation of the present and future potential risks posed by soil contamination. Because burning in the FTA is not currently occurring, air exposures from this activity are not included as a potential route of exposure. However, the contribution of contaminated soil to air exposures is possible as a result of volatilization of the contaminants in soil and/or the generation of fugitive dust. Risks resulting from exposure to contaminated soil through direct contact and inhalation are evaluated as part of the public health and the environmental (both terrestrial and aquatic) risk assessment.

In conducting this baseline risk assessment, certain site-specific conditions limited the scope of plausible exposure scenarios. The contaminated areas are adjacent to an active taxiway used by the NYANG, commercial and private aircraft. The airport is secured to some degree by a perimeter security fence, although there are unmonitored gates in the fence. Because this area is zoned LI-200 (light industrial), it is not considered likely to become residential or be used for some other purpose that would increase the opportunities for exposure in the foreseeable future. These constraints limit the exposure posed to public health. The focus of this risk assessment is potential exposures to workers, specifically those involved should construction activities occur at the FTA.

The following discussion covers identification of contaminants of concern, public health exposure and risk characterization, and potential impacts to the natural environment.

11.2 SELECTION OF CONTAMINANTS OF CONCERN

At the FTA, the number of chemicals identified in the soil and groundwater was not large, relative to typical hazardous waste disposal sites. The list of compounds identified and the media in which they were observed are listed in

Table 11-1. Chapter 10 presents a discussion of contaminant distribution at the site.

From the list of 20 compounds in Table 11-1, nine were selected as contaminants of concern. These are listed in Table 11-2. Of those nine, the five PNA's were summed, based on potency, and treated as one composite compound. The criteria for selection of this subset of compounds were toxicity, frequency of detection, and not suspect laboratory contaminants. If a compound is only detected very few times relative to the number of samples collected (102 at this site) that data is not considered sufficient to generalize those findings to the entire site.

2-Butanone was chosen to represent groundwater contamination. Analytical data for two sampling rounds are available for 10 groundwater monitoring wells. 2-Butanone, toluene, xylene, 1,1-dichloroethane, chloroform, and bis-(2-ethylhexyl)phthalate were detected at various concentrations. 2-Butanone (methyl ethyl ketone) was detected in significantly higher concentrations and at a greater frequency than the other contaminants. Although benzene is a carcinogen it was not chosen as a contaminant of concern. Benzene was detected in only one monitoring well on one sampling round and was at relatively low concentration (13 ppb). The first sampling round detected 2-butanone in four of the 10 wells at levels ranging from 65 to 56,000 ppb. The second sampling round detected 2-butanone in six of the 10 wells at concentrations ranging from 18 to 14,000 ppb. 2-Butanone was chosen as a contaminant of concern based on the relatively high levels (i.e., maximum of 56,000 ppb) detected and the frequency (10 times) in groundwater near the FTA site. Most other contaminants (seven) were detected once, and only one was detected twice.

Eight indicator chemicals were selected to represent soil contaminants. These included VOCs, SVOCs, and lead. The only VOC detected at concentrations substantially above the detectable limit was xylene, which was detected in both surface and subsurface soils. For the SVOCs, several PNAs were identified, although at relatively low frequency. Bis-(2-ethylhexyl) phthalate was a frequently detected SVOC. The only inorganic compound of concern was lead, which was found in higher concentrations in the surface soils than the subsurface soils. Lead was also the most frequently detected contaminant (85 times).

11.3 CONTAMINANT-SPECIFIC HEALTH-BASED ARARS

In consideration of the NCP and SARA, potential ARARs have been identified for the Suffolk County Airport site. A general description of ARARs and an approach to ARARs development for the site was presented in Section 4.2. This section presents the contaminant-specific health-based values that limit the concentration of a chemical that can be found in or discharged to the environment. They can be used for the quantitative public health risk assessment. They also will govern the extent of site remediation by providing either actual clean-up levels or the basis for calculating such levels, if clean-up levels are to be derived. In addition, potential ARARs would be used in an FS to refine remedial response objectives, modify potential alternatives, and formulate new alternatives, if necessary.

TABLE 11-1

FREQUENCY OF CONTAMINANT DETECTION[1]
SUFFOLK COUNTY AIRPORT FTA

Compound	Frequency of Occurrence by Media: Soil[2]	Groundwater[3]
o VOCs		
xylenes	8	1
benzene	1	1
tetrachloroethene	2	1
toluene	4	1
chlorobenzene	1	--
2-butanone	--	10
1,1 dichloroethane	--	1
chloroform	--	1
o SVOCs		
PNAs		
chrysene	3	--
phenanthrene	4	--
pyrene	4	--
benzo(a)anthracene	1	--
2-methylnapthalene	7	--
napthalene	3	--
fluorene	1	--
bis(2-ethylhexyl)phthalate	2	2
dibenzofuran	1	--
phenols	2	--
n-nitrosodiphenylamine	1	--
o Metals		
Lead	85	1

[1] Does not include compounds found in field blanks (acetone and methylene chloride); Does not include oil and grease; Does not include compounds found at levels less than the contract required detection limit.

[2] 102 soil samples were analyzed.

[3] 21 groundwater samples were analyzed.

-- Not present above the contract required detection limit.

TABLE 11-2

SELECTION OF CONTAMINANTS OF CONCERN
SUFFOLK COUNTY AIRPORT FTA

Soil	Water
VOCS	VOCS
Xylene	2-Butanone

Soil

VOCS

Xylene

SVOCS

Bis (2-ethylhexyl)phthalate*

PNAs[t]

Benzo(a)anthracene*
Benzo(a)pyrene*[1]
Benzo(b)flouranthene*[1]
Chrysene**
Pyrene*

INORGANICS

Lead

*Carcinogens

**Suspect carcinogens

t Total carcinogenic PNAs were assessed

[1] These compounds were selected based on their carcenogenic potential even though they were not present above the contract required detection limit.

Contaminant-specific health-based ARARs for the Suffolk County Airport FTA are presented in Appendix L, Table L-1. Table 11-3 presents actual values for dose-response assessment for the contaminants of concern at the Suffolk County Airport FTA, based on the ARARs identified in Table L-1.

It is only possible to compare the ARAR's for the groundwater data, as there are either no ARAR's or no environmental data for the other media. Thus, only 2-butanone, lead, and xylene can be compared. The 2-butanone levels at MW-107B (both round 1 and 2 samples) and MW-101B (round 2 only) exceed the USEPA drinking water equivalency level (DWEL) for lifetime exposure. The maximum concentrations for lead and xylenes in groundwater did not exceed the National Drinking Water Regulations (MCL's).

11.4 TOXICITY PROFILES FOR CONTAMINANTS OF CONCERN

Toxicity profiles for contaminants of concern are contained in Appendix M.

11.5 FATE AND TRANSPORT OF CONTAMINANTS OF CONCERN

11.5.1 Groundwater

Monitoring wells containing high levels of 2-butanone are located approximately 0.75 miles upgradient from the municipal wellfield. There is concern for the potential migration of 2-butanone into the wellfield area, as these wells serve as a potable water supply for the local community. To evaluate the potential exposure and subsequent risk from 2-butanone, data describing both the distribution of 2-butanone contamination in this area and transport and fate of this chemical must be evaluated. Adequate data on the distribution of 2-butanone contamination and transport of this chemical to the wellfield are not currently available. Without this information, it is not possible to predict whether 2-butanone impacts the well field or the concentration of 2-butanone in the municipal wellfield, and thus the potential human exposure to this contaminant.

11.5.2 Soils

As discussed in Section 10, several factors at this site restrict the transport of contaminants in the soil. First, the FTA is currently not used for fire training; therefore, there is no new source of contaminants being introduced to the soil. Second, while the compounds identified at the site at elevated concentrations and frequencies (e.g., lead and PNAs) have been found in the soil, these compounds do not have high water solubilities.

The three plausible transport mechanisms for contaminants in soil are migration to groundwater, surface runoff, and atmospheric dispersion. Few contaminants which were found in the soils at the FTA where identified in the groundwater. Specifically, lead, bis(2-ethylhexyl)phthalate, toluene, tetrachloroethene, benzene, and xylene. These compounds were only detected once, except for bis(2-ethylhexyl)phthalate which was detected twice. And as noted previously, the lead concentration was below the USEPA drinking water regulation. No PNA's were detected in groundwater. The data indicate, that under current

TABLE 11-3

APPROPRIATE STANDARDS, GUIDELINES, AND CRITERIA
FOR DOSE-RESPONSE ASSESSMENT
SUFFOLK COUNTY AIRPORT FTA

Chemical	MCL (a) (mg/L)	MCLGs (b) (mg/L)	Health Advisory (c) 10-Day (mg/L)	Health Advisory (c) Lifetime (mg/L)	RfDs (d) (mg/kg/day)	CAG UCR (e) (mg/kg/day)[1]	Freshwater AWQC To Protect (f) Aquatic Life (ug/L) Acute	Freshwater AWQC To Protect (f) Aquatic Life (ug/L) Chronic	AWQC (g) To Protect Human Health (ug/L)	NAAQS (j) (ug/m^3)	TLVs $\mu g/m^3$
2-Butanone (MEK)	-	-	7.5	0.17	0.05	-	-	-	-	-	--
Bis(2-ethylhexyl) phthalate	-	-	-	-	-	6.84 E-4 (oral)	940 (h)	3 (h)	21,000	-	--
Lead	0.05	0.020*	20 ug/day	-	-	-	82 (k)	3.2 (k)	50	1.5	150
PNAs	-	-	-	-	-	11.5(i) (oral)	-	-	0	-	--
Xylenes (total)	-	0.44*	27.3	2.2	-	-	-	-	-	-	100

(a) MCL: National Primary Drinking Water Regulations (40CFR141).
(b) MCLGs: Proposed National Primary Drinking Water Regulations (FR50:219:46880; November 13, 1985.
(c) Health Advisories: EPA Office of Drinking Water; September 30, 1985.
(d) Risk Reference Doses: EPA Environmental Criteria and Assessment Office; January 1986.
(e) CAS UCR: EPA Carcinogen Assessment Group (CAG) Unit Cancer Risks (UCRs) as published in Mutagencity and and Carcinogenicity Assessment of 1.3-Butadiene EPA/600/8-85/004F; September 1985.
(f) AWQC: Ambient Water Quality Criteria as published in Quality Criteria for Water 1986; EPA 440/5-86-001; May 1, 1986.
(g) AWQC: Adjusted for drinking exposure only.
(h) Based on total phthalate esters.
(i) UCR for benzo(a)pyrene, currently being revised. Values being considered are lower than this value.
(j) NAAQS for lead is based on a 90-day average.
(k) Based on an assumed hardness of 100 mg/ℓ.
* Proposed.

conditions, migration to the groundwater by these compounds is not significant. As noted previously, the sandy soils are porous and surface runoff is not a likely occurrence. Atmospheric dispersion is the most plausible transport for the contaminants in the soil. This would occur though the generation of fugitive dust or volatilization of contaminants in the soil. These two processes are considered possible because the FTA is not covered with vegetation. However, the adjacent wooded areas would act as a barrier to long distance transport. Disruption of the soil through construction activities and the subsequent generation of fugitive dust is considered the most plausible transport mechanism.

11.6 PUBLIC HEALTH EXPOSURE ASSESSMENT

This section presents the rationale and assumptions that were made to estimate exposures to contaminants present at the FTA.

11.6.1 Determining Exposed Population and Principal Routes of Exposure

The FTA at Suffolk County Airport is located adjacent to an actively operating taxiway. The Airport is fenced, although not securely locked, and warning signs are posted. The FTA site itself is not fenced. According to municipal zoning codes, the area is zoned LI-200 (light industrial). No residential homes are located within one-half mile of the FTA site. The environmental layout and the restricted access to the FTA area makes exposure to the contaminants detected at this site extremely unlikely for the general population. Trespassers (including young teens) are not expected to access this area on a regular basis, and any access that may occur is expected to be short in duration. Young children are not expected to have access to this area. The only persons likely to access the FTA and potentially contact the contaminants detected at the site are workers who may be involved in construction and/or maintenance activities, and firefighters who would use the area for training. However, exposure by construction workers would be much more extensive and of longer duration than exposure by firefighters.

Based on the predicted activities of construction workers (e.g., excavation, building), exposure to contaminated soils is possible. Exposure to contaminants may result from direct dermal contact with surface and subsurface soils and/or inhalation of chemical vapors or contaminated fugitive dust generated during working activities. Exposure scenarios were developed based on this information to provide an estimate of the potential worker exposure to contaminants in this area. These scenarios are based on the following assumptions for exposure parameters:

- Population at Risk: adult workers
- Exposure Route: inhalation and dermal absorption of entrained contaminated soil particles
- Duration: construction activities would be of limited duration (it is assumed that these activities would cover a five-week period)

- o Frequency: the average construction worker would be exposed for 8 hours/day for 5 days/week

These exposure parameters are used to estimate the body dose (in micrograms per kilogram of body weight per day) of a contaminant that an exposed individual would receive. The estimated body doses are used in the next section to predict the incremental lifetime cancer risk and the potential non-carcinogenic health effects. Where possible, values used to estimate inhalation and route-specific absorption rates were obtained using USEPA guidance (USEPA, 1986a) and the current scientific literature.

11.6.2 Inhalation of Air Contaminants

The inhalation of air contaminants represents a potential source of exposure. Airborne contaminants would exist in two forms: volatilized contaminants and fugitive dust. However, volatilized contaminants do not appear to present a significant exposure at this site. Review of the contaminant levels of VOCs (principally xylene) in the subsurface soil indicates that xylene is not present in sufficient quantities to present a detectable airborne concentration at a worker's breathing level. A photoionization detector was used to survey for VOCs during drilling operations. Some subsurface soil samples produced readings in the range of 25-35 ppm at the air-soil interface assumed to be xylene. With atmosphere dilution, these levels are not high enough to produce breathing level exposures. This was confirmed during drilling as no VOCs were detected in the breathing zone. Therefore, exposure to volatilized contaminants was not quantitatively assessed in the exposure scenarios.

Fugitive dust represents a more probable source of air exposure. Lead, PNAs, and bis(2-ethylhexyl)phthalate are present in the soil and could become airborne in the form of fugitive dust.

Body dose levels of inhaled contaminants were estimated using the following equation:

$$B = \frac{C \times I \times F}{W}$$

B = body dose		µg/kg/dy
C = concentration in air		$\mu g/m^3$
I = inhalation rate		m^3/dy
F = fraction adsorbed		
W = body weight		kg

Atmospheric contaminant concentrations (C) were estimated based on a review of the scientific literature for lead (USEPA, 1986b). In this document, studies that measured airborne concentrations concurrently with soil concentrations were compiled. The studies represent various dispersion conditions and soil types. A generalized relationship between soil and air was then derived. USEPA (1986b) provided the following generalized relationships:

Concentration of Lead in Air (ug/m^3)	General Concentration of Lead in Soil (ppm)
0	5 - 30
0.1	20 - 90

Using the average lead concentration detected in surface and subsurface soils, detected at the FTA (18.8 ppm) as the basis for estimating airborne concentrations, Jordan assumed a concentration of 0.1 ug/m^3 lead resulting from undisturbed soils, and a concentration of 1.0 ug/m^3 lead from disturbed soils for example during excavation. In the absence of dispersion modelling data (which was beyond the scope of this project), these concentrations are considered to provide a reasonable estimate of airborne lead levels. It is assumed conservatively that all the lead in fugitive dust emissions will be in the respirable size fraction range of particles. In the absence of literature values for lead concentrations in disturbed soils, it was further assumed that the atmospheric concentration of Pb would be an order of magnitude higher for disturbed soils as opposed to undisturbed soils for worst case. Thus, for soils in the range of 20 to 90 µg Pb/g, the estimated concentration under the most probable case is 0.1 µg Pb/m^3 and under the realistic worse case is 1.0 µg Pb/m^3. The size distribution of soil particles generated by mechanical abrasion (e.g., trucks on unpaved roads) is a function of the percent silt in the soils and other factors. The soils at the FTA (coarse grained surface soils over coarse sands and gravels) are expected to generate relatively large dust particles (i.e., greater than 10 µm) predominantly. The percentage of particles of this size range which are deposited in the respiratory tract is low. Thus, the assumption that all airborne lead is respirable is conservative.

Airborne concentrations of PNAs and bis(2-ethylhexyl)phthalate were estimated in a similar manner. This was justified because these compounds are adsorbed onto soil particles and it can be assumed that the same physical dispersion processes would apply. Thus, a similar generalized relationship between the soil and air would hold. However, the soil concentrations of both of these compounds are three orders of magnitude less than the lead concentrations. For example, carcinogenic PNAs maximum concentration was 0.99 µg/g, and bis-(2-ethylhexyl)phthalate was present in lower concentrations. Based on qualitative screening results, PNAs and bis(2-ethylhexyl)phthalate concentrations in fugitive dust would not be detectable. These contaminants were thus dropped from any further analysis.

Lead is the only contaminant considered to be present at detectable concentrations in fugitive dust; therefore, it is the only compound assessed in the following section. Because many of the exposure assumptions used to quantify exposure are difficult to predict, a range of values are used to estimate the potential exposure to lead. By developing exposure estimates based on both most probable and realistic worst-case exposure conditions, a range of plausible exposures doses are developed.

Two exposure scenarios are developed to estimate the range of potential exposure to lead by a worker. The most probable case exposure scenario is based on the following "average" exposure assumptions:

Exposure Concentration	0.1 ug/m^3
Inhalation Rate	10.4 m^3/day
Fraction Absorbed	20%
Body Weight	70 kg

The realistic worst-case exposure scenario is based on more conservative exposure estimates:

Exposure Concentration	1.0 ug/m^3
Inhalation Rate	20.8 m^3/day
Fraction Absorbed	40%
Body Weight	70 kg

The fraction absorbed is based on US EPA (1986b) where it was estimated that adults in urban industrial areas absorb 15-30% of inhaled lead. The two different inhalation rates are based on 8 hours of exposure for light activity (1.3m^3/hr) and moderate activity (2.6m^3/hr). As these are worker exposures, the duration is 5 days/week for 5 weeks.

The above assumptions are used to estimate risks for lead exposures. The results are presented in Section 11.7.2.

11.6.3 Dermal Contact with Soil

Direct contact with contaminated soils occurs through direct physical contact with the soil. The equation used to estimate body dose levels via this route of exposure is as follows:

$$B = \frac{C \times S \times F}{W}$$

where B = body dose, µg/kg/day
C = concentration in soil, µg/g
S = soil contact rate, g/day
F = fraction absorbed, unitless
W = body weight, Kg.

For carcinogens, duration of exposure averaged over a lifetime is taken into account. The values used to calculate most probable and realistic worse case exposures are:

	Most Probable Case	Realistic Worst Case
Soil Concentration (µg/g)	18.8 (ave.)	148 (max.)
Soil Contact Rate	(0.5 mg/cm^2)x(1980 cm^2)*	(1.5 mg/cm^2)x(1980 cm^2)*

* Surface area based on hands and forearms exposed for adult males. Source is Andersen et al., (1985).

The average and maximum soil concentration values are based on surface soils data only (0-2 ft. depth). This is the expected depth to which normal maintenance activities would disturb. The soil contact rate is a function of the amount of soil contacted and the exposed surface area. For workers, it was assumed only hands and forearms would be exposed. The contact rate was varied from 0.5 to 1.5 mg/cm^2. The surface area is based on Andersen et al., (1985) values for adult males. The USEPA guideline to assume 100 percent absorption is excessively conservative. For lead, dermal absorption of lead in cosmetic preparation has been observed to occur in humans with a maximal efficiency of 0.3 percent (ATSDR, 1988). It is highly unlikely that lead absorbed to sandy soils will be absorbed at a similar rate as when applied in cosmetics. For this analysis, an absorption rate of 0.1 percent was used for the most probable case and a very conservative (based on ATSDR, 1988) 10 percent used for the realistic worst case. (Values used to calculate risk from all media are summarized again in Section 11-7 and Table 11-4). Heavy metals are not readily absorbed through the skin. Jordan has reviewed toxicological data on dermal and ingestion absorption efficiencies. It was determined that a range of absorption efficiencies, depending on the compound, is more appropriate. These values are presented in Section 11.7.2.

11.7 RISK CHARACTERIZATION

To assess the potential risks associated with the exposures described earlier, a dose-response assessment is performed. The dose-response assessment presents standards and criteria that are quantitatively used to assess human health risks. The human health risk characterization, which follows this section, contains a description of the methodology used to evaluate the human health risks associated with exposure to lead and the results of the quantitative risk assessment. (The risks to the aquatic and terrestrial ecosystems are discussed in the environmental risk assessment.)

11.7.1 Human Health Dose-Response Assessment

11.7.1.1 Groundwater. The indicator chemical of concern in groundwater is 2-butanone. Although exposure and risk due to this chemical cannot be assessed due to the lack of information on distribution of contamination and transport and fate, the Risk Reference Dose (RfD) is stated here to provide some indication of its toxicity. The RfD value is a verified route-specific reference dose or acceptable daily intake developed by the USEPA Criteria and Assessment Office. The RfD for chronic oral exposure to 2-butanone is 0.05 mg/kg/day. The concentration of 2-butanone in drinking water corresponding to a dose of 0.05 mg/kg/day is 1,750 ppb (assumes a 70-kg adult consumes 2ℓ of water per day). The value of 1,750 ppb can be used to assess the potential risk from exposure to 2-butanone in the municipal well water, once the concentrations of 2-butanone are refined. However, due to the lack of information, the remainder of this risk assessment addresses only the contaminants detected in the soils.

11.7.1.2 Soils. The contaminants of concern in the soils are PNAs, bis-(2-ethylhexyl)phthalate, xylenes, and lead. There are no federal or state standards, guidelines or criteria that address soil contamination. However, exposure to these compounds could occur through fugative dust generation (for SVOCs and lead), volatilization (for xylenes), and dermal contact. For inhalation exposure, it is estimated that concentrations of the SVOCs and xylene would not be detected (see Section 11.6.2). Thus, the dose-response discussion for inhalation focuses on lead.

Because the route of exposure is inhalation of fugitive dust containing lead, the OSHA and USEPA-promulgated standards for lead can be used. The standard chosen for reference for the FTA is the National Ambient Air Quality Standard (NAAQS) for lead (1.5 ug/m^3). OSHA promulgates standards for worker protection; however, they are much higher than NAAQS and for lead the TLV is 150 $\mu g/m^3$. To provide a conservative estimate of risk, the more protective standard is used (NAAQS of 1.5 ug/m^3).

Since the NAAQS is based on a 90-day arithmetic mean concentration (ug/m^3), this value had to be converted to units comparable to body dose levels (i.e., ug/kg/day). A value of 0.17 ug/kg/day was obtained using the following equation and using the same exposure assumptions used under realistic worst-case exposures:

$$\text{Pb Standard (ug/kg/day)} = 1.5\ ug/m^3 \times \text{inhalation volume} \times \text{absorption/(body weight) factor}$$

Where: o inhalation volume is 20.8 m^3/8 hr., based on moderate activity
o absorption factor is 0.4 for inhalation
o body weight is 70 kg

For dermal contact with soils the following reference levels were used:

Lead - MCLG of 20 μg/ℓ; at an ingestion rate of 2 ℓ/day and 70 kg body weight this equals 0.57 μg/kg/day.

Xylene - IRIS, the USEPA database, cites an AIC of 2000 μg/kg/day.

Bis(2-ethylhexyl)phthalate - CAG (Carcinogenic Assessment Group, USEPA) gives a potency value of 6.84×10^{-4} $(mg/kg/day)^{-1}$.

PNAs - All carcinogenic PNAs were assumed to be as potent as benzo(a)-pyrene (which is very conservative). The CAG potency value is 11.5 $(mg/kg/day)^{-1}$. This value is currently being revised downward by CAG; the new value is not yet available.

11.7.2 Human Health Risk Characterization

Body dose levels of lead were calculated in Section 11.6 based on the exposure scenarios developed for inhalation. As stated in the toxicity profile, lead is not considered to be carcinogenic; therefore, only noncarcinogenic risks were estimated in this section.

Carcinogenic risk estimates were determined by multiplying the body-dose level for each carcinogen by its USEPA carcinogenic potency value. This estimate represents an individual's incremental cancer risk. To put these incremental risk levels into perspective, they should be evaluated against a target risk level.

Target risk levels have been adopted from USEPA guidelines which state that the total incremental carcinogenic risk for an individual resulting from exposure at a hazardous waste site should be between 10^{-4} and 10^{-7}. Therefore, remedial alternatives should reduce total potential carcinogenic risks to levels less than 10^{-4} (USEPA, 1986). Based on USEPA guidelines, this report refers to carcinogenic risk estimates as being "below the target range" when risks are less than 10^{-7}, "within the target range" when risks are 10^{-7} to 10^{-4}, and "above the target range" when risks are greater than 10^{-4}.

Noncarcinogenic risk estimates are determined by dividing body-dose levels for each noncarcinogen by the relevant standard, criterion, or guideline, resulting in a ratio called the risk ratio. The sum of the individual risk ratios for specific contaminants at a site is called the hazard index for the mixture. If this ratio is less than or equal to 1.0, no adverse health effects are anticipated from the predicted body-dose level. If the ratio is greater than 1.0, the predicted body-dose level could potentially cause adverse health effects. This determination is necessarily imprecise because derivation of the relevant standards or guidelines involves the use of multiple safety factors. In addition, the risk ratios for individual compounds should properly be summed only if their target organs or mechanisms of action are identical. Therefore, the potential for adverse health effects for a mixture having a hazard index in excess of 1.0 must be assessed on a case-by-case basis.

For the FTA site, the estimated body dose for lead for a given exposure scenario is divided by the contaminant-specific NAAQS.

Dermal contact was evaluated for the following compounds: xylene, carcinogenic PNAs, bis-(2-ethylhexyl)phthalate, and lead. A preliminary screening of the these compounds was performed based on conservative exposure estimates (see Table 11-4). This was done to determine which compounds would present a potentially significant risk based on exposure considerations. If compounds were not considered to present a significant exposure under conservative assumptions, then the assumed exposure and subsequent risks would be even lower under more probable exposure conditions. Compounds screened out were not quantitatively evaluated in the risk assessment.

All the compounds evaluated (xylene, carcinogenic PNAs, bis(2-ethylhexyl)-phthalate, and lead) had low body dose levels under conservative exposure assumptions (8.2×10^{-6} to 3.2×10^{-5} ug/kg/day). Screening risk estimates were developed to assess whether these exposure dose levels present a potentially significant risk (see Table 11-5). For the carcinogens, PNAs and bis(2-ethylhexyl)phthalate, the upper bound carcinogenic risk was on the order of 10^{-8} and 10^{-12}, respectively. These risk estimates fall below the target clean-up range of 10^{-4} to 10^{-7} (corresponding to 1 excess incidence of cancer in 10,000 to 10,000,000) and therefore are extremely low. For lead and xylene, the risk ratios for the noncarcinogenic effects were 0.11 and 9.5×10^{-7}, respectively, for the worst case. These risks were calculated according to the values presented in Table 11-4. These risk ratios are less than one, indicating minimal risk. All risk estimates generated based on conservative exposure assumptions indicate that direct contact exposure to soils is not a significant route of exposure. Therefore, soil dermal contact exposures are not further evaluated.

Table 11-6 summarizes the basic assumptions that were discussed in Section 11.6.2 and are used to calculate exposure to lead via inhalation. The most

TABLE 11-4

EXPOSURE VIA DIRECT CONTACT WITH SOILS BY WORKERS
DURING EXCAVATION
SUFFOLK COUNTY AIRPORT FTA
(Onsite - 0 - 2-foot depth; Present Conditions)

Parameter	Most Probable Case	Realistic Worst Case
1. Frequency of Contact (days/year)	25	25
2. Years of Exposure	1	1
3. Absorption Fraction		
VOCs:	10%	50%
SVOCs:	1%	10%
Lead:	0.1%	10%
4. Average Weight over Exposure Period (Kg)	70	70
5. Amount of Soil Contacted (g/day)	0.99	2.97

TABLE 11-5

RISK RATIOS AND CARCINOGENIC
EXCESS RISK
SUFFOLK COUNTY AIRPORT FTA

Chemical	Average Concentration (µg/g)	Maximum Concentration (µg/g)
Xylene	0.003	0.091
Carcinogenic PNAs	0.049	0.99
Bis(2-ethylhexyl)phthalate	0.119	1.1
Lead	18.8	148
Noncarcinogenic Hazard Ratio		
Lead:	4.6×10^{-4}	0.11
Xylene:	2.1×10^{-9}	9.5×10^{-7}
Carcinogenic Excess Risk		
Carcinogenic PNAs	7.7×10^{-11}	4.7×10^{-8}
Bis(2-ethylhexyl)phthalate	1.1×10^{-14}	3.1×10^{-12}

TABLE 11-6

WORKER EXPOSURE VIA LEAD INHALATION
DURING EXCAVATION
SUFFOLK COUNTY AIRPORT FTA

Parameter	Most Probable Case	Realistic Worst Case
1. Frequency of Contact (days/year)	25	25
2. Years of Exposure	1	1
3. Absorption Fraction Lead:	20%	40%
4. Average Weight over Exposure Period (Kg)	70	70
5. Inhalation Rate (m3/day)	10.4	20.8
6. Concentration ($\mu g/m^3$)	0.1	1.0

probable case of exposure assumes no soil disturbance at the site and assumes a concentration of airborne lead of 0.1 ug/m³. The realistic worst-case scenario assumes soil disturbance from construction and an estimated air concentration of 1.0 ug/m³. Absorption factors and inhalation volumes are also varied to bracket the lower and upper bound risk estimates.

Table 11-7 presents the lower and upper bound risk ratios developed for lead. Both the upper and lower bound risk ratios fall below unity (0.017 and 0.69, respectively) indicating minimal risk to human health. For comparison, if the TLV for lead is used for reference rather than the NAAQS, the risks decrease by approximately 2 orders of magnitude. These risks are estimated based on current site conditions and assumed exposure patterns. As long as the concentrations of lead and other contaminants detected in the soil do not significantly increase (i.e., from future burning or dumping activities) and access to the area is considered limited, these risks will reflect the risks to workers that are associated with the site, assuming no remedial action is taken. The future potential risks will be similar to those calculated previously.

11.7.3 Environmental Risk Characterization

Several potential environmental receptors of contamination exist at the Suffolk County Airport site: Aspatuck Creek, Quantuck Creek, nearby undeveloped pine barrens (including the Quogue Wildlife Refuge), and the site area itself. As discussed in Section 6.4, there is virtually no runoff from the site, indicating that transport of contaminants into Aspatuck Creek or Quantuck Creek is probably limited. Discharge of groundwater from the site is another potential pathway for transport of contaminants into the creeks. Based on analytical data for soils and groundwater, lead and 2-butanone are the only contaminants that appear to potentially pose a risk to aquatic environments. Other compounds which were identified in the groundwater (see Table 11-1) were not found frequently enough to be considered representative of groundwater contamination. Lead has a chronic AWQC value of 3.2 ug/ℓ (assuming a hardness of 100 mg/ℓ as $CaCO_3$). No lead was present above the detection limit of 5 ug/ℓ in the site monitoring wells. The effects of 2-butanone on aquatic life are not well documented. No AWQC or criteria documents are available for 2-butanone. However, the high concentrations of 2-butanone present in the groundwater may present a risk to aquatic life. The VOCs and PNAs found at the site are not expected to pose a hazard to aquatic ecosystems based on levels observed in soils and groundwater.

As discussed in Section 3.3, the undeveloped pine barrens near the site provide habitat for birds, mammals, amphibians, reptiles, and terrestrial invertebrates. It is probable that most of these organisms will remain in the undeveloped areas and hence will not be exposed to contaminants in site soils. An exception would be direct contact by organisms crossing the site during migration or feeding; however, these would be short-term incidental exposures and probably not result in significant exposures. Another potential exposure pathway is by birds or insectivorous mammals ingesting terrestrial invertebrates that have bioconcentrated contaminants (primarily lead) in their tissues. Overall, however, impacts to terrestrial ecosystems are expected to be limited, based on levels of contaminants detected in site soils and the limited potential for contaminant migration.

TABLE 11-7

RISK RATIOS FOR LEAD INHALATION EXPOSURE
SUFFOLK COUNTY AIRPORT FTA

Condition	Concentration (ug/m3)	Inhalation Rate (m3/day)	Fraction Absorbed	Body Weight (kg)	Body Dose (ug/kg/day)	Standard/ Guideline (µg/kg/day)	Risk Ratio
Most Probable Case	0.1	10.4	0.2	70	0.003	0.17	0.017
Realistic Worst Case	1.0	20.8	0.4	70	0.12	0.17	0.69

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11.8 RISK SUMMARY

Given the land use at the site, exposure to contaminated media appears to be limited to workers. Although there is potential for exposure to firefighters, the potential is significantly less than for workers. Workers could potentially be exposed during on-site construction. Activities associated with building and excavation are assumed to result in the generation of fugitive dust, thus creating a potential exposure pathway. Even under worst-case exposure assumptions, it does not appear that sufficient air concentrations of lead or other contaminants will be generated to present a health risk, and direct contact with contaminants in soils does not present a significant risk. In addition, there are minimal risks posed to the natural environment by this site.

12.0 SCREENING OF CONTROL MEASURES

This section provides the initial screening of treatment technologies for contaminants of concern at the Suffolk County Airport. Section 11 evaluated the risk of exposure resulting from the contaminants in soils and groundwater at the FTA. A conservative risk scenario demonstrated that the soils at the site do not pose an environmental or human health risk. Therefore, no remedial action is needed for the FTA soils, and no soil remedies will be identified or screened.

The groundwater in the vicinity of the FTA contains only one contaminant (i.e., 2-butanone) that is a potential human health or environmental concern. Groundwater remedial technologies for the 2-butanone are identified and screened in the following paragraphs.

This section contains two subsections: Identification of Control Measures, which identifies potentially applicable groundwater technologies, and Screening of Control Measures, which screens each groundwater technology on the basis of effectiveness, feasibility, and cost.

12.1 IDENTIFICATION OF CONTROL MEASURES

This section identifies groundwater and soil cleanup technologies applicable to the Suffolk County Airport. An applicable technology must be useable for conditions at the site and on the contaminants present therein. For the Suffolk County Airport, consideration is limited to 2-butanone in groundwater. Applicable technologies must reduce risk by either removing or destroying the 2-butanone in groundwater, or by containing the groundwater to prevent migration and subsequent exposure. Table 12-1 contains a list of applicable groundwater treatment technologies. Although the FTA is not a Superfund site, the technologies in Table 12-1 satisfy Superfund criteria.

Feasibility studies consider technologies in the following six categories:

- o no action
- o technologies that provide permanent and significant reduction in the toxicity, mobility, or volume of the waste
- o technologies that include off-site storage, destruction, treatment, or disposal at a RCRA facility
- o technologies that eliminate the need for long-term management
- o technologies for on-site containment
- o technologies that attain applicable or relevant and appropriate federal and state public health and environmental requirements (ARARs)

TABLE 12-1

APPLICABLE GROUNDWATER TECHNOLOGIES
SUFFOLK COUNTY AIRPORT FTA

	Technology Name	Type
1.	Carbon Adsorption	Treatment
2.	Air Stripping/Steam Stripping	Treatment
3.	Ultraviolet Photolysis/Ozonation	Treatment
4.	Resin Adsorption	Treatment
5.	Biodegradation	Treatment
6.	Supercritical Water Oxidation	Treatment
7.	Subsurface Containment Wall	Containment
8.	No Action	No Action

The ANG policy and the recently enacted SARA require that the technologies evaluation consider innovative hazardous waste treatment technologies. The list of applicable technologies includes several innovative technologies. However, technologies that are conceptual (i.e., have never been proven on a laboratory scale) are not considered here.

12.2 SCREENING OF CONTROL MEASURES

The purpose of the initial screening process is to narrow the list of potential remedial actions for further detailed analysis. The initial screening uses three criteria to evaluate technologies: effectiveness, feasibility, and cost.

An effective technology must ultimately provide environmental or public health benefits but must not have significant adverse impacts. Technologies provide this benefit by reducing either the toxicity of the waste or the potential for exposure.

A technology must be feasible for the location and conditions of the site, applicable to the waste and the contaminants present, and reliable. Site characteristics gathered during field investigations may limit or favor the use of certain remedial technologies. Technologies whose use is precluded by waste or site conditions are eliminated from further consideration. The waste's physical/chemical properties such as volatility, solubility, density, and permeability determine the applicability of a technology. A technology must also be reliable in mitigating the risk at the site either through demonstrated performance at other sites or based on bench or pilot studies.

The cost of a technology includes costs of capital construction and operation and maintenance. During initial screening, a technology is rejected from further consideration if it has a substantially higher cost (i.e., an order of magnitude greater) than another technology without providing substantially greater public health or environmental benefits.

The initial screening evaluated six groundwater treatment technologies, one containment technology, and no action. A discussion of each technology, including an evaluation of effectiveness, feasibility, and cost for each, is presented in Appendix K.

The results of the initial screening are presented in Table 12-2. Six technologies passed initial screening. The subsurface containment wall technology failed the screening because it was not feasible for the site conditions. Screening eliminated the supercritical water oxidation technology because it had significantly higher costs than other technologies without providing additional environmental benefits. The initial screening is summarized in Table 12-3.

The remaining tasks for developing a Remedial Action Plan are as follows:

- o Task 3 - Develop Detailed Alternatives
- o Task 4 - Evaluate Detailed Alternatives

TABLE 12-2

INITIAL SCREENING RESULTS
SUFFOLK COUNTY AIRPORT FTA

Technology Name	Result
1. Carbon Adsorption	Passes initial screening
2. Air Stripping/Steam Stripping	Passes initial screening
3. Ultraviolet Photolysis/Ozonation	Passes initial screening
4. Resin Adsorption	Passes initial screening
5. Biodegradation	Passes initial screening
6. Supercritical Water Oxidation	Fails initial screening; costs significantly greater than other technologies without additional benefits
7. Subsurface Containment Wall	Fails initial screening; not feasible
8. No Action	Passes initial screening

TABLE 12-3

SUMMARY OF INITIAL SCREENING
SUFFOLK COUNTY AIRPORT FTA

Technology	Description	Effectiveness	Feasibility
Carbon Adsorption	- Water is passed through a bed of activated carbon to remove organic chemicals. - Effective in removing a broad range of organic chemicals from groundwater.	- Proven technology for removal of some volatile and most semivolatile organic chemicals from groundwater. - Highly volatile organic chemicals not well adsorbed. - Highly contaminated water may require pretreatment such as filtration or precipitation.	- Carbon adsorption could be used for removal of 2-butanone in groundwater at the Suffolk County site. - Equipment can be either assembled on-site or trailer mounted pre-assembled. - Pilot testing required to provide final equipment design. - Monitoring required to determine carbon exhaustion, and necessary replacement/regeneration.
Air Stripping/Steam Stripping	Volatile and semivolatile organic wastes are stripped from groundwater by the use of air or steam.	- Effective for the removal of volatile and some semi-volatile organic wastes from the groundwater. - Removal efficiencies are relatively high.	- Process is easily implemented. - Steam stripping most applicable to volatile contaminants in groundwater. - Monitoring/control of off-gases may be necessary.
UV Photolysis/Ozonation	The process involves contacting organics with ozone in the presence of UV light. The combination of oxidation and photolysis breaks down complex organic molecules, eventually terminating with CO_2 and H_2O.	- No information on application to a complex waste stream on a full scale. - Only clear liquids can be used. - Effective for destruction of many organic compounds including chlorinated hydrocarbons.	- Extensive pilot testing would be necessary. - Could be used on organic contaminants in water. - Water at Suffolk County site has low suspended solids, allowing high light penetration. - Technology has low maintenance.

SUMMARY OF INITIAL SCREENING
SUFFOLK COUNTY AIRPORT FTA

Technology	Description	Effectiveness	Feasibility
Resin Adsorption	- Similar to carbon adsorption, only contaminant is transferred to surface of resin.	- Effective on organic contaminants. - Resins can be specialized for contaminant. - Technology has not been used on actual hazardous waste site.	- Could be effective on groundwater contaminants at site. - Pilot testing necessary. - Similar to carbon adsorption.
Supercritical Water Oxidation	- Water heated and brought under sufficient pressure oxidizes organics in water.	- Technology has been effective at the pilot scale. - Monitoring and control necessary because of high temperature and pressure. - Destruction efficiencies high at pilot scale.	- Fuel must be added if organics are not in sufficient concentration in wastestream (1%-5%). - Concentration in Suffolk County site groundwater is generally below one percent. - Very high cost.
Bioreclamation	- Bacteria are used to anaerobically or aerobically degrade organic groundwater contaminants.	- Technology has been proven reliable on actual sites as well as in pilot testing. - Environment must be free of potential toxins to bacteria.	- Treatment could be in-situ, on-site (mobile unit), or off-site (specialized plant or POTW). - Groundwater could be treated by biodegradation.
Subsurface Containment Wall	- Constructed of low permeability material generally keyed into bedrock or impermeable soils. - Designed to control groundwater movement and chemical migration in permeable soils.	- Extensively demonstrated for controlling movement of groundwater. - Controlling of chemical migration not well demonstrated. - No maintenance required. - May require a perimeter drainage system.	- Bedrock and impermeable soils are much too deep for feasible implementation of a barrier wall.

SUMMARY OF INITIAL SCREENING
SUFFOLK COUNTY AIRPORT FTA

Technology	Description	Effectiveness	Feasibility
No Action	- No remedial alternatives are implemented on the site.	- Volume, mobility, or toxicity of contaminants is not reduced.	- Applicable. - There are no site or contamination characteristics that would preclude "no action." - NCP regulations and CERCLA as amended require that no action alternatives be evaluated.

- Task 5 - Describe Selected Alternative
- Task 6 - Prepare Environmental Assessment
- Tasks 7-10 - Prepare Remedial Action Plan

The other task included in the Work Plan is Task 12 - Prepare Designs and Specifications. In summary, these tasks provide a detailed evaluation of remedial alternatives, and select and design the most appropriate alternative for the site. Jordan will begin work on these tasks if so directed by the ANG through ORNL.

13.0 CONCLUSIONS AND RECOMMENDATIONS

Based on results of the RI and baseline risk assessment, conclusions drawn from the site information and recommendations for further action are presented in the following sections.

13.1 CONCLUSIONS

Soils. The only potential significant exposure to contaminated soils at the FTA would be to construction workers if excavation or building were to occur at the site. Workers would be exposed to fugitive dust resulting from excavation or construction activities. Firefighters training at the FTA would not be significantly exposed because fugitive dust from soils would not be created by fire training. Even using a worst-case scenario for construction workers, no significant health risk would result. There are also minimal risks to the environment from the FTA soils.

Air. The lead levels in the soil are not high enough to cause the NAAQS to be exceeded, even under a conservative risk scenario.

Groundwater. There is no significant fuel contamination in the groundwater at the site. The low levels of benzene, toluene and xylene in the groundwater are not expected to pose significant risk to human health or the environment.

There are high concentrations of 2-butanone present in the site groundwater both upgradient and downgradient of the FTA. The RI did not define the magnitude and distribution of the 2-butanone groundwater contamination. Therefore, the risk of this contamination is not known.

Groundwater at the site flows in a southern to southeastern direction. It does not flow toward the petroleum, oils, and lubricants storage area (POL) or toward the homes on Peters Lane where previous groundwater contamination occurred. Groundwater flow direction in the vicinity of the FTA is toward Quantuck Creek and the east of the Suffolk County Water Authority wellfield.

The FTA does not appear to be the source of the 2-butanone contamination in the groundwater. Extensive soil sampling at the FTA detected 2-butanone in only 2 locations and both were below the detection limit of 0.01 ppm (values below the detection limit are not considered reliably detected).

The estimated travel time for the groundwater to reach MW-107B from the FTA is about three years. Since 1971, the ANG has improved FTA operations and burned only jet fuel (JP-4) at the site; therefore, it is unlikely that the 2-butanone results from fire-training activities.

The depth of contamination in the groundwater and the occurrence of 2-butanone in the upgradient wells indicate a source upgradient (i.e., north) of the FTA. Upgradient well MW-101B contained concentrations up to 1,400 ppb of 2-butanone.

13.2 RECOMMENDATIONS

- Because no significant risks are posed by the FTA soils, no further action or investigation is necessary to address soil contamination at the FTA.

- No significant petroleum contamination is present in the site groundwater. Therefore, no further investigation of the impact of the FTA on groundwater is necessary.

The following recommendation is for off-site activities:

- The magnitude and distribution of the 2-butanone in the groundwater and its source are not known. The high concentrations of 2-butanone and the direction of groundwater flow near the site indicate that an indeterminate risk to the Meetinghouse Road water supply wells may exist. Additional investigation of the 2-butanone groundwater contamination is advisable.

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15.0 GLOSSARY OF ACRONYMS

ANG	Air National Guard
ANGSC	Air National Guard Support Center
ARAMCO	Arabian American Oil Company
ARARs	Applicable or Relevant and Appropriate Federal and State Requirements
CAG	Carcinogen Assessment Group
CIP	Caucus Inorganic Procedure
CLP	Contract Laboratory Program
COP	Caucus Organic Procedure
CNS	Central Nervous System
DOD	Department of Defense
FTA	Fire Training Area
GC	Gas Chromatograph
HMTC	Hazardous Materials Technical Center
HSL	Hazardous Substance List
IRP	Installation Restoration Program
NAAQS	National Ambient Air Quality Standards
NCP	National Contingency Plan
NYANG	New York Air National Guard
NYSDEC	New York State Department of Environmental Conservation
NYSDOL	New York State Department of Law
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Administration
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PNAs	Polynuclear Aromatics (same as PAHs)
ppb	parts per billion
ppm	parts per million
QAPP	Quality Assurance Project Plan
RAP	Remedial Action Plan
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
SARA	Superfund Amendments and Reauthorization Act
SCAFB	Suffolk County Air Force Base
SCDOH	Suffolk County Department of Health
SVOCs	Semivolatile Organic Compounds

USAF	United States Air Force
USEPA	United States Environmental Protection Agency
VOCs	Volatile Organic Compounds
WBAAF	Westhampton Beach Army Airfield

UNITED STATES
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EASTPORT QUADRANGLE
NEW YORK–SUFFOLK CO.
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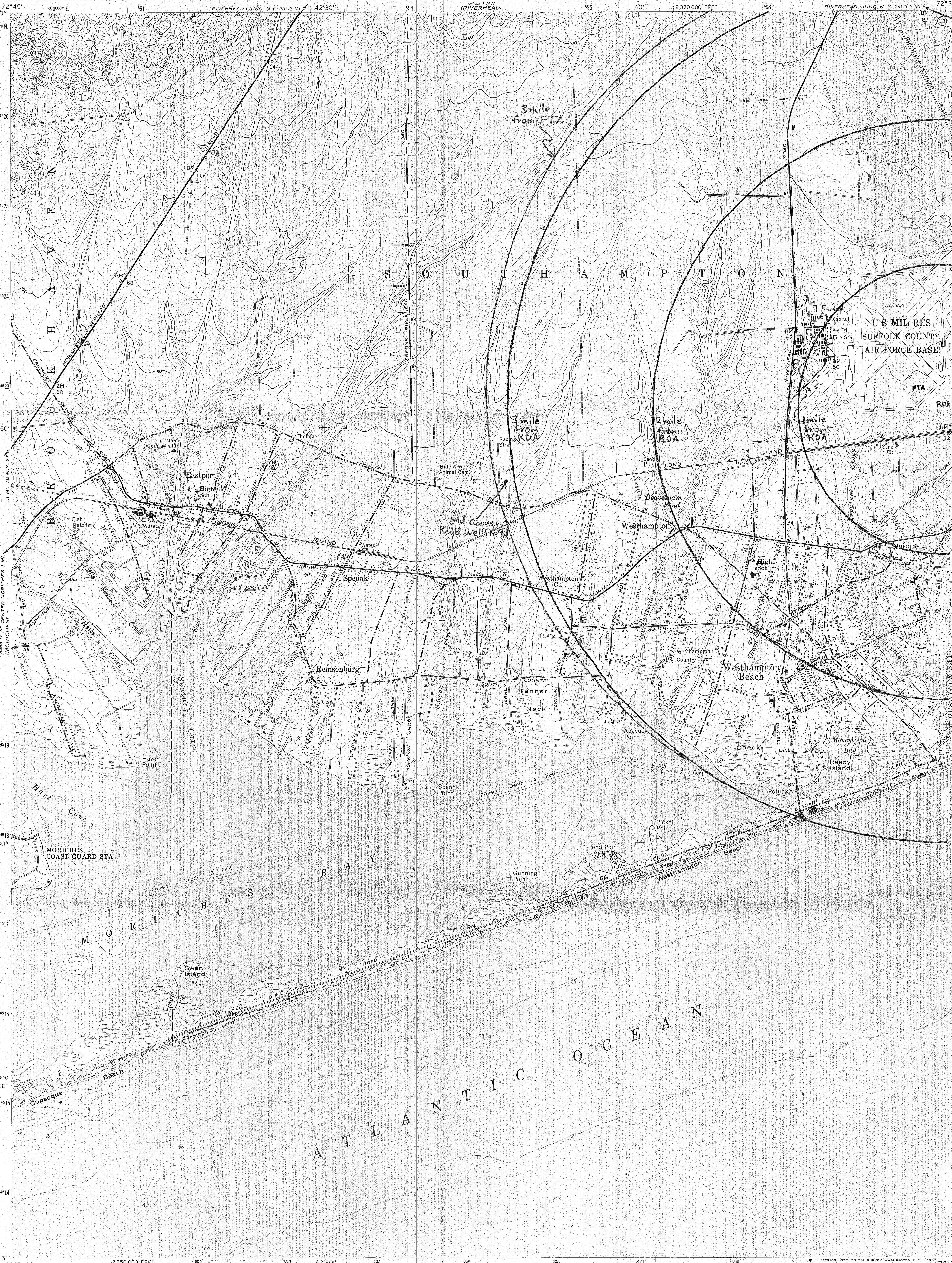
SW/4 RIVERHEAD 15' QUADRANGLE



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Culture and drainage in part compiled from aerial photographs taken 1954 Topography by planetable surveys 1956.

Hydrography compiled from USC&GS charts 578 (1956) and 1214 (1954)

Polyconic projection. 1927 North American datum
10,000-foot grid based on New York coordinate system, Long Island zone
1000-meter Universal Transverse Mercator grid ticks, zone 18, shown in blue

Fine red dashed lines indicate selected fence and field lines visible on aerial photographs. This information is unchecked

UTM GRID AND 1956 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24000

CONTOUR INTERVAL 10 FEET
DASHED LINES REPRESENT 5-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOW WATER
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 2.9 FEET ALONG THE OCEAN AND 0.5 FOOT IN INLAND WATERS
THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
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A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

NEW YORK
QUADRANGLE LOCATION

ROAD CLASSIFICATION
Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
State Route

EASTPORT, N. Y.
SW/4 RIVERHEAD 15' QUADRANGLE
N4045—W7237.5/7.5
1956
AMS 6465 I SW—SERIES V821

Reference 8

IDENTIFICATION	ELEVATION TOP OF CASING	ELEVATION GROUND
MW-101 A	50.89	47.88
MW-101 B	51.82	48.45
MW-102	45.43	(FM)
MW-103	44.97	(FM)
MW-104	50.11	46.88
MW-105	50.33	46.86
MW-106	49.01	45.65
MW-107 A	49.42	46.58
MW-107 B	48.93	45.56
MW-107 C	49.38	46.17
P-1	45.32	42.75
P-2	48.85	
P-3	44.64	41.84
P-4	50.13	46.89
MW-9	48.96	47.25
MW-10	47.64	45.66
MW-11	47.46	45.46
MW-14	44.86	42.91
MW-22	48.29	46.19
MW-23	43.87 TOP. P.V.C.	41.73
MW-24	45.99	44.11
POL-1	26.24	25.11
POL-2	34.58	32.93
POL-3	44.83	42.63
POL-4	47.36	45.86
MW-00X	47.79	47.79

BENCHMARK: VERTICAL DISC. M 38 1932 AT WEST HAMPTON R.R. STATION ON WEST FACE AT NORTH END OF STATION. ELEVATION 48.96'. DATUM MEAN SEA LEVEL = 0.00'. BASED ON N.G.V.D..

LEGEND
- TRAVERSE POINT
- MONITORING WELLS INSTALLED E.C. JORDAN CO.
- EDGE OF BITUMINOUS
- EDGE OF CONCRETE TAXIWAY
- FENCE
- RAILROAD
- CONCRETE CATCH BASIN
- MONITORING WELLS INSTALLED PREVIOUSLY BY THE AIR NATIONAL GUARD.
- (FM) FLUSH MOUNTED WELL
- MONITORING WELL INSTALLED PREVIOUSLY BY THE SUFFOLK COUNTY DEPARTMENT OF HEALTH.

SURVEY BY	DATE
R T G	5-20-87
SURVEY FILE NO. 100,067	
FIELD BOOK No. E-840	

REV.	DATE	STATUS	MF	BY	CHKD	APPD
B	8-18-87	ISSUED TO SOILS DEPT.		MLN	JPRC	JPRC
A	7-24-87	ISSUED TO SOILS DEPT.		MLN	JPRC	JPRC

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CLIENT

DESIGN	
DRAWN	MLN
CHKD.	JPRC
DEPT. HD.	JPRC
PROCESS	
PROJ. MGR.	
CLIENT	
SCALE	1" = 100'

TITLE
WEST HAMPTON BEACH, NEW YORK.
SUFFOLK COUNTY AIRPORT
(FIRE TRAINING AREA)

PROJ. NO. 5096-01
DWG. NO.
REV. B

0 1 2 3 4 5 6 INCHES
0 1 2 3 4 5 6 CENTIMETERS

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MN GN
12½°
222 MILS
1°36'
28 MILS

UTM GRID AND 1956 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

1 ½ 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

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